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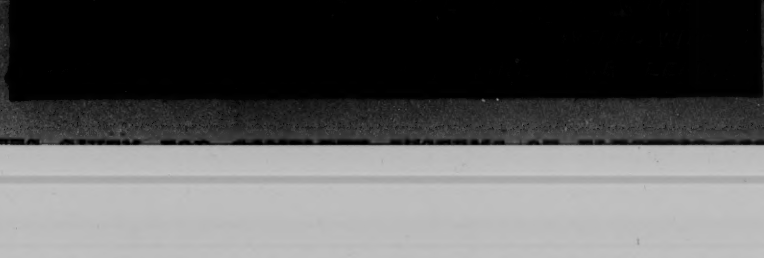

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THE TELEGRAPHIC JOURNAL AND
Electrical Review.
VOL. XV.—NO. 356.

AERIAL NAVIGATION.

MUCH attention has recently been concentrated upon the experiments made in France by two French military officers, MM. Renard and Krebs, in their endeavours to navigate and steer balloons with, or against, the wind. The first aerial voyage undertaken by these gentlemen, during the early part of last month, was declared by enthusiastic aeronauts to have solved the problem, so long sought, of aerial navigation. Electricity was called to the aid of the adventurous voyagers and the balloon was, by means of a screw geared to a dynamo-electric machine, to be propelled in the teeth of a gale or in any direction whatsoever.

A full and illustrated account of this interesting experiment is given in our other columns.

Unfortunately, later trials have failed to carry out the wished-for ends of the inventors, and it is to be feared that another complete failure must be added to an already long list of impracticable ideas.

The second ascent was made on Friday, the 12th inst., at Meudon, but this time without the success which attended the former experiment. There was a good wind blowing, but on the previous occasion there was only a slight breeze. After resisting the wind and remaining stationary, or nearly so, for a few minutes, the balloon was carried in the direction of Versailles, and on one of the batteries ceasing to work descended near Versailles. From there the balloon had to be dragged back to Meudon. The inventors assert that, but for the accident to the battery, they would have returned to Meudon in the teeth of the wind.

Naturally enough the inventors are most sanguine of eventual success, but when one considers the weight of the battery, the dynamo, and the supplementary gearing attached thereto, together with the risks of a breakdown in each part or all of the apparatus, it is to be feared that the difficulties attendant on aerial navigation are rather increased than otherwise in the Renard-Krebs aerostat.

An interesting ceremony in connection with ballooning took place during the present week. The first aerial voyage in England is said to have taken place from the Honourable Artillery Company's ground at Finsbury on the 15th of September, 1784, in the presence of the Prince of Wales, afterwards George IV., and preparations were made to fittingly celebrate the 100th anniversary of the event, which occurred on Monday last. Three huge balloons ascended from the grounds at the rear of the Finsbury Armoury, whence, at five minutes after two in the afternoon, just a century before, Mr. Lunardi, the secretary to the Neapolitan Ambassador in London, started upon the first aerial voyage performed in this country, and ultimately descended, at 20 minutes past four, in safety in a meadow at Standon, near Ware, Hertfordshire. This balloon was furnished with wings and oars; the use of the former was to excite the air when becalmed, and thereby to move the aerostat horizontally; they had the form of large rackets, and were covered with a loose flounce of oiled silk. The oars, which differed from the wings only in size, were to be worked with a vertical motion, intended to effect a depression of the machine, by which the aeronaut hoped to be enabled either to check its ascension or to descend without the necessity of letting out the inflammable air. This he appears to have accomplished, for, although one of the oars broke and fell as he ascended, with the other, after hard labour of 15 or 20 minutes, he descended.

On Monday M. L'Hoste, secretaire de L'Académie d'Aérostation Météreologique de Paris, accompanied General Brine, R.E., in his celebrated balloon the "Colonel," which has made four voyages across the Channel, as did also Captain Baylis, of the Honourable Artillery Company. This balloon, which holds 35,000 feet of gas, rose majestically in the air shortly after four o'clock, immediately ascending to a considerable altitude, and sailing away before a current of air in a north-westerly direction. Soon afterwards it was followed in the like direction by Mr. Dale's balloon "Monarch," holding about 28,000 feet of gas, and finally, about five o'clock, ascended Mr. Youens' "Robin Hood" balloon, holding 23,000 feet of gas. The requisite gas was supplied from a four-foot main by the Gas Light and Coke Company, under the superintendence of Mr. Harris, C.E. Subsequently, in the Long Room, Colonel Beaumont, R.E., presiding, M. Wilfried de Fonvielle, a name well known to electricians, delivered an address, in which he described the improvements made in the construction and the gear of balloons during the past century, particularly alluding to the improvements effected by the late Mr. Green, the inventor of the cone anchor, which had been the means of saving the lives of so many aeronauts when they had drifted out to sea, and had been rescued by passing vessels. He spoke hopefully and sanguinely of the ultimate success of the efforts now being made by French officers to steer balloons by the medium of electric currents, and to which we have already alluded. We are not quite so hopeful, however, as M. de Fonvielle, nor do we hold a very sanguine opinion respecting the contrivance of Captain Kosztowitz, the Russian aëronaut, whose cigar-shaped balloon is noticed in another part of the REVIEW.

CAUSES OF DEATH BY INTENSE ELECTRICAL ACTION.

By C. M. GARIEL.

THE accidents produced by the action of intense currents have become somewhat frequent of late years; a consequence to be expected from the recent development of electrical industry. It would be of little interest to give here a summary of the accidents which have occurred, because in general the circumstances are ill-defined, and because we have no details of the internal derangements which have taken place, and which may be considered as the cause of death.

On account of this lack of precise documents, we think it will be interesting to give a detailed account of the accident which took place at the Tuileries on the Festival of the Press (Aug. 6th, 1882), and which involved the death of two persons. In consequence of this accident, Professor Brouardel and myself were charged to draw up a report. For various reasons we thought fit to defer its publication, which is now unobjectionable.

During the evening, two young men endeavouring to scale the wall of the sunk fence which separates the garden of the Tuileries from the old reserved garden, were entangled in an electric wire which had been laid down for the illuminations. A garde de Paris, who had witnessed the descent, not seeing them reappear, went to the spot and found them stretched out in the trench, the one dead, whilst the other died a few minutes later. The place where the death of Emile Martin and Joseph Kenarec took place is the sunk-fence separating the old reserved garden from the garden of the Tuileries in the part comprised between the Seine and the Central Avenue. This sunk-fence is straight for a part of its length, presents a re-entering, and then runs on for a fourth of the circuit up to the Central Avenue.

The trench on the side of the reserved garden presents a slope of 45° covered with turf, as a continuation of the lawns in the reserved garden, more than 10 metres in width to the right of the place where the accidents took place.

On the occasion of our visit, the turf slope presented very distinct traces of the foot-marks of persons who had descended or climbed the slope. In consequence of the moist weather the turf was not completely dry.

The bottom of the trench, about 1 metre in width, is formed of earth slightly beaten down, but the surface had been recently raked at the time of our visit. Beneath the soil, along the length of the trench, there runs a drain of sufficient capacity to give passage to a man. In this drain, towards its upper part, is suspended a metallic pipe.

The second face of the sunk-fence consists of a perpendicular wall of masonry of 1·90 metres in height, having at intervals projections corresponding to the pedestals of the statues in the garden. Half-way between these projections are water-spouts of metal with open cups at their upper end, and terminating below the cornice of the wall. Lastly, on the side of the garden of the Tuileries there runs a metal balustrade of 1 metre in height, fixed into the top course of stone of the wall by metal uprights at intervals of 2 metres.

On the side of the Central Avenue, towards the point where the trench terminates, there are fences of iron wire to hinder the public from descending into the sunk-fence. These fences are damaged, as if they had been exposed to the pressure of a crowd.

The wires serving for the transmission of the electricity are two in number. On the one hand, they abut on an elevated stage erected in the garden of the Tuileries near the Central Avenue. On the other hand, they are carried up a tree, where they are fixed by means of insulators, and are thence led to another post.

At both ends in the descending portion the wires are coated with a non-conducting material. The wires then run horizontally along the face of the wall below the coping, and are kept in their place by small cords attached at intervals to the uprights of the balustrade, and this to a certain distance at each end from the points where they have taken a horizontal position. In the intermediate portion where the accident took place it is necessary to examine the arrangements more closely.

One of the wires was coated or insulated for its whole length. It is fixed to the summit of the re-entering angle, which we have mentioned, and passes thence to a point near the water-spout. In this extent it hangs slack, and forms by its weight a curve, so that it touches one of the salient angles of the slope.

According to the depositions of the engineer of the firm X, who had fitted up this installation, the wire should not have presented any slack parts ; it ought to follow the wall up to the point where it was fixed, and from thence pass in a straight line to the apex of the re-entering angle. This point may be considered as established, since we found a cord placed at the point where the wire should have been fixed to the upright of the balustrade, and which appeared to have been recently broken.

The second wire is not coated towards the extremity of the circular part. From this point it is supported by porcelain insulators, fixed very firmly by ties of iron wire. The wire was stretched so tightly that it was impossible to make it touch the metal articles near which it passed. At the other end it was again coated with an insulating material.

This second wire does not appear to have undergone any change of position since it was fitted up.

Conditions under which the accidents took place.

From an examination of the place, from a comparison of the depositions of the witnesses, and from the results of the autopsy, we may conceive under what conditions the accidents must have happened.

1. Kenarec was standing at the summit of the slope, or on the slope near the re-entering angle. He received a push or made a false step (perhaps under the influence of wine), and descended the slope precipitately and against his will. He thus came in contact with the coated wire, which was stretched tightly, and which, catching him by the middle of the body, threw him down. By this collision the little cord was broken, the wire became slack, and Kenarec was thrown to the bottom. Instinctively he stretched out his hands before him, seized the other naked wire, and received the electric shock whilst his feet were still on the slope. We may think that in this fall his feet might touch the cast-iron plate at the foot of the slope ; but I do not believe it, and the depositions of the witnesses do not give any precise details as to the exact manner of his fall.

2. Martin was in the trench, and was trying to raise himself up so as to see into the garden, or penetrate into it. Having placed his right hand on the top of the coping, or on the insulated wire, he grasped the naked wire with his left hand, and seeking to pull himself up he brought the wire in contact with his body, where it made a large burn. He fell without doubt immediately, and the wire which he let go struck him slightly about the ear, being no longer held in his hand. It might be supposed that his right hand had been placed upon the cup of the water-pipe which forms a projection. But although the depositions are not very clear, it seems that his fall was at some distance from this pipe.

Physical Causes of the Death of Martin and Kenarec.

It appears from the depositions of the engineer of the firm X, that the circuit of which the wire in question forms a part comprises 12 Siemens lamps, actuated by an alternate current machine placed in the court of the Tuileries. The number of lamps thus placed in circuit enables us to estimate the mean difference of potential which must exist between the outgoing and the returning wire, and which would be about 500 volts. The difference of potential between one of these wires at the point considered and the ground, or the ambient air, may be regarded as approximately equal to half this value, or 250 volts. But it is important to remark that in machines where the current is produced by induction, the difference of potential does not retain a constant value, as in case of a current furnished by a battery, but passes through values alternately maximum and minimum, the maximum having naturally an intensity notably higher than the mean.

The duration of the period of variation of the current is very short, so that however brief may be the duration of contact, it will comprise at least one maximum, so that the value of such maximum is important to be particularised, but it is not exactly known. In the case of alternating currents, the difference of potential between the absolute values of the two maxima of opposite directions which follow each other in a very short interval of time may be considered as approximately equal to double the absolute value of one of them.

However this may be, contact took place with a wire in which there was circulating a current corresponding to electricity of a potential very much higher than that of the ambient space.

It is difficult to specify the mode of action of the electricity. Was there a static discharge? Was there a current between the wire and the earth? Was there merely a derivation of current through the bodies of the victims?

The two former hypotheses, without being absolutely inadmissible, do not appear probable, It is known, in fact, in all workshops where powerful electric currents are employed, that we may touch the conductors with perfect impunity so long as the ground upon which we stand, without being a perfect insulator, is at least an imperfect conductor. But in this case the conditions seem analogous. The ground, especially in Martin's case, was dry, or nearly so, and was consequently a bad conductor. We do not believe that the presence of the metal pipe in the drain could have an appreciable influence. As for Kenarec, the turf was perhaps a better conductor, but it was almost dry, since it had not then been watered. We do not think that his feet could have touched the plate of cast iron covering the drain whilst his hands grasped the wire.

In support of our opinion we may further cite the depositions of the witness Charles Hubert, who, likewise standing in the trench, touched the naked wire with his hand. His arm was jerked backwards by the shock which he felt, but he experienced no other consequences.

We must then admit that death has been the consequence of the passage of a part of the current through the body brought in contact with two different points of the naked wire.

This condition of double contact seems to have been produced in both cases. It appears from the autopsy that *both* the hands of Kenarec bore distinct traces of burning, and that in the case of Martin the cheek, the neck and the ear, on the one hand, were distinctly burnt by contact with the wire, whilst on the other the left hand presented a mark which may likewise be attributed to a burn.

We are, therefore, led to the opinion that death resulted from a derivation of a part of the current through the body. The intensity of the derived current this produced could be only a small fraction of the total current, for the resistance offered to the passage of the electricity by the organised parts traversed is enormous in comparison with the resistance of a copper wire of 6 millimetres in diameter, and of a length of a few decimetres, which represents the distance between the points where the derivation was established. But it is far from being proved that, in the action of electricity upon organised beings it is the intensity of the current, that is to say, the quantity of electricity which determines the results produced. Perhaps even the fall of potential has to be taken into account. Perhaps, also (and we should be personally inclined to admit that it is so), it is the energy which determines the magnitude of the action, *i.e.*, the product of the quantity of electricity by the fall of the potential.

We remark here that this is in some degree analogous with the effects produced by heat. The importance of burns is determined much more by the temperature (which corresponds to the potential) than by the quantity of heat.

During the contact, however short, we must, moreover, conceive that the body thus placed in derivation in the current has participated in the variations in the magnitude of the potential which are manifested in the wires in consequence of the alternating currents, and that its potential must have passed rapidly through very different values.

Moreover, to explain the death, it is not necessary to suppose a very energetic action. The electricity has not directly produced grave material changes, which might be in themselves the cause of death. The burns observed, the sole immediate consequences of the electric action, were in themselves of no moment. The electricity acted indirectly by suspending the action of the nervous system, and this suspension was the cause of death. The action manifested in this case is like that of a catch, which the most feeble effort is sufficient to displace, and which falling upon a toothed wheel is able to arrest a powerful machine. There is no relation between the magnitude of the cause and that of the effect produced.

It may seem, though this is a point upon which we do not enter without great reserve, that the action upon the nervous system to which we refer may be that of the electricity upon the higher portion of the spinal marrow, which would agree well with the manner in which Kenarec and Martin were attacked.

We may remark in passing that the burns observed must be due to the discharge produced between the wire and the skin on separation, and not on contact with the wire heated by the current. Besides that, a copper wire of about six millimetres in diameter especially exposed to the open air can only become heated a few degrees; the witness Hubert, who also touched the wire, did not perceive any appreciable rise of temperature.

We do not think it necessary to insist on the results of the autopsies made, the one at the Morgue, the other at Gros-Caillon, results which are laid down in the reports of Drs. Brouardel and Bourrot. To these reports we refer only to show that, as already stated, there was no material lesion caused by the electricity, and capable of directly occasioning death. We may also add that we proceeded to a spectroscopic examination of the blood of Martin, which presented all the normal characters of this liquid.

(*To be continued.*)

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—MONTREAL, 1884.

(*Continued from page 209.*)

Second Report of the Committee, consisting of Sir Joseph Whitworth, Sir W. Thomson, Sir F. J. Bramwell, Mr. A. Stroh, Mr. Beck, Mr. W. H. Preece, Mr. E. Crompton, Mr. E. Rigg *(Secretary)*, Mr. A. Le Neve Foster, Mr. Latimer Clark, Mr. H. Truman Wood, *and* Mr. Buckney, *appointed for the purpose of determining a Gauge for the manufacture of the various small Screws used in Telegraphic and Electrical Apparatus, in Clockwork, and for other analogous purposes.*

1. Since the presentation of its first report on a gauge for small screws at the meeting of the Association held in 1882, at Southampton, this committee has further examined into the recommendations there made, with the result that they now have to propose some important modifications, the general effect of which will, it is felt, be to materially facilitate the introduction of the system.

2. The want of unanimity on the part of the committee referred to in paragraph 7 of that report, arose mainly on the question as to whether the inch or millimetre should be taken as a unit of measurement. It is evident that if either is rigidly adhered to and in any way employed in the nomenclature of the screws, as, for example, in specifying the diameter, pitch, or threads per inch or per mm., the same dimensions could not be expressed in whole numbers in the other unit, and thus a material obstacle would be at once introduced to its general adoption.

3. It should be pointed out, however, that it has hitherto been the common practice to designate such small screws as the committee alone is considering, not by any specific dimension, but by a number, which as a rule is abitrarily chosen and does not of itself form a guide to the size of the screw. Considering, then, that the unit of measurement is only indirectly connected with the subject of a screw gauge, the committee has felt that the two units might be reconciled so far as relates to such a subject, and that thus one important difficulty would be removed.

4. The manner in which the series of screws adopted lately by Swiss manufacturers is correlated has been sufficiently explained in the previous report, and very full explanations are given in the two original pamphlets to which reference is there made.* The diameter (D) is related to the pitch (P) by the formula $D = 6\,P^{\frac{6}{5}}$ (1) all measurements being in millimetres, and P having successively the values 1 (or $0{\cdot}9^0$) mm.; $0{\cdot}9^1$ mm.; $0{\cdot}9^2$ mm.; $0{\cdot}9^3$ mm. . . . $0{\cdot}9^n$ mm.

Thus, *n*, the index, becomes a convenient designating number for the screw, and the formula (1) may be expressed $D = 6\,(0{\cdot}9^n)^{\frac{6}{5}}$, where $P = 0{\cdot}9^n$.

5. The pitch of any screw can be at once ascertained from its designating number by raising 0·9 to the power indicated by that number; and from this pitch the diameter is directly deducible by the formula (1), so that the number (*n*) given in the first column of the table, by which a screw is known, is intimately related to all its dimensions.

PROPOSED SMALL SCREW GAUGE.

Number.	Nominal Dimensions in Thousandths of an inch.			Absolute Dimensions in Millimetres.	
	Diameter.	Pitch.	Threads per Inch.	Diameter.	Pitch.
I	II.	III.	IV.	V.	VI.
25	10	2·8	353	0·25	0·072
24	11	3·1	317	0·29	0·080
23	13	3·5	285	0·33	0·089
22	15	3·9	259	0·37	0·098
21	17	4·3	231	0·42	0·11
20	19	4·7	212	0·48	0·12
19	21	5·5	181	0·54	0·14
18	24	5·9	169	0·62	0·15
17	27	6·7	149	0·70	0·17
16	31	7·5	134	0·79	0·19
15	35	8·3	121	0·90	0·21
14	39	9·1	110	1·0	0·23
13	44	9·8	101	1·2	0·25
12	51	11·0	90·7	1·3	0·28
11	59	12·2	81·9	1·5	0·31
10	67	13·8	72·6	1·7	0·35
9	75	15·4	65·1	1·9	0·39
8	86	16·9	59·1	2·2	0·43
7	98	18·9	52·9	2·5	0·48
6	110	20·9	47·9	2·8	0·53
5	126	23·2	43·0	3·2	0·59
4	142	26·0	38·5	3·6	0·66
3	161	28·7	34·8	4·1	0·73
2	185	31·9	31·4	4·7	0·81
1	209	35·4	28·2	5·3	0·90
0	236	39·4	25·4	6·0	1·00

6. It is evident that by taking the exact successive powers of 0·9 for the pitch, complex numbers would soon be arrived at. Such dimensions would, however, involve a degree of accuracy which is hardly attainable in practice, and it may be shown that, with two significant figures employed throughout to express the pitch, the degree of accuracy likely to be attained in screws of the kind under consideration is reached. Relying on this fact, the series of pitches given in Column VI.† is arrived at for screws ranging from ·236 in. to the smallest in use, 0·01 in. in diameter, in place of the mathematically exact series obtained by raising 0·9 to successively higher powers.‡ And this is the series which the committee recommends for adoption.

7. Viewing the numbers thus obtained in the first place merely as a graduated series of pitches, and ignoring the unit of measurement, it may be admitted that the series of powers of 0·9 from which they are deduced is perhaps as good a one as can be suggested for the purpose, and it is found to very closely correspond with experience. Thus Column VI., which gives the nearest approximation to this series that is practically required, is well adapated for such a system of screws. It is to be observed that in selecting a series of pitches there are three simple alternatives to choose from: (1) to have a constant arithmetical difference between successive pitches, in which case either the pitches of small screws would differ by too great an amount, or those of the larger screws by too small an amount; or (2) to divide the entire range into sets, in each of which the differences are constant. The third alternative is to take successive powers of some other simple fraction, for example 0·8, but such a series would not so well correspond with the screws most generally employed.

8. Accepting this series, it may, however, be urged that it should be based on some aliquot part of an inch rather than on the millimetre. But any advantages to be gained by such a modification are inappreciable. For an examination of the numbers at once shows that they are, for the most part, awkward fractions of a millimetre, and the metric system of measurement thus enjoys no advantage in this respect over that based on the inch. From the point of view of interchangeability, however, of screws to be manufactured in this country and on the Continent, it is essential that the same basis of measurement of the pitch be everywhere adopted; because, having agreed upon only two significant figures on one basis, terminable decimals are obtained, but such terminable decimals could not be accurately expressed by two significant figures on the other basis of measurement.

9. Again, it is to be remembered that the use of metric measurement to designate the pitch need not inconvenience English manufacturers who are desirous of cutting the screws in their lathes. For, as has recently been pointed out by Mr. Bosanquet,* it is easy to cut a thread whose pitch differs from one millimetre by an amount which may for all ordinary purposes be neglected ($\frac{1}{55300}$th), with a guide-screw based on the inch by the addition of a wheel of 127 teeth, and thus the series here recommended could, on the rare occasions that it became necessary, be originated on any screw-cutting lathe provided with the requisite wheels. But the committee do not consider it needful to specially contemplate facility in the originating of the threads, as the screws under consideration are made in a plate or by the aid of dies; and manufacturers on a large scale would be provided with a special lathe for the purpose.

10. Whether the inch or millimetre is adopted as a unit of measurement the series of pitches for these small screws becomes an ideal rarely attained in practice, for with screws tapped in a plate, or even with dies, the exact pitch aimed at will often not be attained; neither is it safe to assume that two screws, tapped in corresponding holes in different plates, will have precisely the same number of threads per inch. This is especially the case with the smaller screws, as may be proved by accurately measuring the pitches of several tapped in holes that are nominally alike.

11. The fact here stated affords a reason against extending the practice of designating screws by their number of threads per inch, already sometimes resorted to in the case of large screws, to the screws now under discussion. It is found that screws, nominally alike, frequently differ in this respect by as much as five or even ten threads in the inch, nor need this occasion surprise when it is remembered that the screw-plates employed must expand to varying extents in the hardening, that the hole is often not more than three or four threads deep, and that the pressure applied by hand, must vary considerably. Such a nomenclature would thus involve the use of inconveniently high numbers to express a minute degree of accuracy but seldom attained, while they convey but little real information, since mere examination would not enable any one to distinguish between, say, a screw of 169 and 181 threads per inch.

12. The series of diameters must next be considered. Before the formula $D = 6\,P^{\frac{6}{5}}$ was adopted, it was ascertained by the minute examination of about 140 small screws that the series very closely corresponds with those recognised as good in the trade, and the screws made in the new plates, known as *Filières Suisses*, which the committee have had an opportunity of examining, appear to them to be well proportioned in this respect. The series of diameters, like the pitches, are expressed by two significant figures in each case, as the values for D deduced from the formula (1) are necessarily indeterminate in most cases. These diameters are given in millimetres in column V., and their nearest equivalent in thousandths of an inch in column II. As the committee considers that these screws are well-proportioned as regards pitch and diameter, and approves the formula (1) being taken as a basis, it is led to recommend this series of diameters being adopted in conjunction with the pitches already discussed. It has been suggested to the committee that the introduction of such a system into general use in this country might be facilitated by punching against each hole in the screw-plate, side by side with the designating number, as given in column I., the approximate diameter of the screw made in it, as expressed in thousandths of an inch (column II.), as these numbers would convey a meaning to English workmen more definite than the numbers in column I. or V. The committee sees no serious objection to such a course; but it should be remembered that screws have hitherto always been recognised by a number seldom higher than twenty-five, and it may be questioned whether any substantial advantage is gained by substituting such high figures as are involved in the expression of the diameters.

13. It will be seen that the series here recommended gives twenty-six screws for the range from ¼-inch to the smallest in use. Comparing this number with those of two of the best systems commonly met with,—namely, the Latard (Perrelet et Martin) and Bourgeaux plates, we find that—

For a range of 21 sizes of watch screws on the Latard plate, this gives … … …	15
For a range of 23 sizes of watch screws on the Bourgeaux plate, this gives … … …	17
For a range of 36 sizes of clock screws on the Latard plate, this gives … … …	23

The entire series is thus less than that of well-established plates, and cannot, therefore, be considered greater than the requirements of practice demand; while the fact that the watchmakers (who probably require the most extensive assortment of screws) in Switzerland have accepted it, confirms the committee in its opinion that the series is not deficient in this respect.

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* *Systématique des vis Horlogères*, by Prof. M. Thury, Geneva, 1878. *Notice sur le Système des vis de la Filière Suisse*, Geneva, 1880, by the same author.

† It may be incidentally pointed out here that this series comprises two screws, with pitches of 1 mm. and 0·25 mm., which would be serviceable for micrometers.

‡ Sir Joseph Whitworth's gauge, in general use, ends at ¼ in., where this commences.

* *Phil. Mag.* (Fifth Series), vol. xv., pp. 217, 438.

14. It remains to consider the form of thread. There are so many practical points to be taken into consideration in discussing such a question that it becomes specially useless to rely much on theory for guidance, and the divergence observable among the forms adopted by different manufacturers is thus very great.

The most important points to be borne in mind in its selection are:—

(1) The threads must be easily cut with the class of screw-cutting tackle ordinarily met with in workshops.

(2) The strength of the threads on the male and female screws must be so correlated that the liability of either to strip is a minimum.

(3) The resistance of the core to torsional stress when force is applied in rotating the screw must be a maximum.

(4) The friction should be as small as possible, in order to reduce wear.

15. In regard to the first of the above conditions it is to be observed that very many of the screws considered by the committee are usually made by means of a plate in which are round, tapped holes. Such a hole forms a thread by causing the metal to "flow" from a space towards a thread, and its action is obviously of quite a different character from the cutting action of dies or of a chasing tool. In the case of plates with notched holes the cutting and squeezing actions are combined.

16. As bearing on the second condition, it is evident that, as the strength of the threads depends so essentially on the materials of which the screw and nut are made, and these are very varied, no precise and invariable rule is attainable. If strength were the only point to be considered, a purely triangular form without any rounding would be best, contact being assumed to take place over the entire surface. But in practice it is impossible to secure such perfect contact, and it becomes needful to round off the crests from all the threads; and this rounding is the more necessary as the screws are smaller and irregularities in the manufacture become relatively more marked. This modification is also necessary in view of condition (1) already considered.

17. The third point—namely, the resistance of the core to torsional stress—is determined primarily by the depth of thread. If the sectional area of the ring cut away is less than that of the core, the probability of the latter breaking across may be regarded as approximately equal to that of the threads stripping; but it is impossible to maintain a constant ratio, as such a condition would require the thread to be so fine in the case of small screws that there would be no sufficient hold in the nut. Thus in the very smallest screws (those below ·030-in. in diameter) the ratio $\frac{\text{area of core}}{\text{sectional area of thread}}$ is less than 1, and it gradually increases till a proportion of between 2 and 3 is attained.

18. Condition (4) is evidently best satisfied by a square thread. Such a form is, however, impracticable in the case of the small screws under consideration, but it is obviously approximated to according as the angle of a triangular thread is made less and the rounding greater.

19. The angles that have been adopted in practice show, as might be expected, considerable variation. On the one hand an angle of 60° is rarely exceeded, the thread being thus derived from the equilateral triangle, and, on the other hand, 45° may be taken as the lower limit.

20. The depth of a thread is evidently a function both of its angle and of the amount of rounding at the top and bottom. It may conveniently be expressed as a fraction of the pitch (taken as unity). In the case of the small screws in general use the mean value of the depth thus expressed is found to be 0·563, the maximum being 0·771, and the minimum 0·311. It is evident that any increase in the depth beyond what is essential will materially and needlessly increase the difficulty of manufacture when a screw-plate is used; at the same time the depth must not be too much reduced on account of the greater tendency of the thread to strip. It is further important that the additional torsion involved in cutting a deep thread, which materially increases the risk of tearing the metal across, should not be lost sight of.

21. The committee, after comparing together a large number of different forms of thread, some of which are in actual use, while others have only been suggested, were much tempted to recommend the Whitworth thread for adoption by the British Association, because it is so well known in this country, and experience has proved indisputably that it is excellent when employed for engineers' bolts, &c. But, as appears from sections 16 and 18, in the case of small screws the tendency should rather be to increase the rounding on account of the difficulties of manufacture, and the depth of the Whitworth thread is 0·64 of the pitch, which is considerably in excess of 0·563, the average adopted in practice. The Whitworth thread is, moreover, characterised by a greater angle than is usual in small screws.

22. The advisability of modifying the form of thread of small screws as compared with those of greater diameter is fully recognised by the Swiss Committee, their thread for the former having an angle of 47½°, while that for the latter is 53°, nearly the same as that of the Whitworth thread. In the case of small screws made in the *Filière Suisse* the crest of each thread is rounded off with a radius equal to $\frac{1}{6}$th the pitch, and the hollow with $\frac{1}{5}$th the pitch. The actual depth is 0·60 the pitch, somewhat less than in the Whitworth thread.

23. While approving the general form of thread here described, this committee could not but feel that the difference in the roundings ($\frac{1}{6}$th at the top and $\frac{1}{5}$th at the bottom) was unnecessary. Looking, moreover, to the fact that very many of the screws of the sizes now under consideration are for electrical and telegraphic instruments, and, therefore, may be of brass, and that, with threads of such dimensions, it is impossible for the eye to ascertain whether a given screw satisfies the required conditions in regard to such small differences between the crest and hollow of the thread, the committee feels that an equal rounding ($\frac{2}{11}$ths of the pitch) at the top and bottom would be preferable. This would maintain the angle of thread and the depth the same—namely, 47½° and $\frac{3}{5}$ths of the pitch respectively.

24. Having now discussed the three main points that require to be considered in any system of screws—namely, the pitches, diameters, and form of thread, it seems desirable to enumerate briefly the recommendations at which the committee has arrived. These are:—

(1) That the series of diameters for screws from $\frac{1}{100}$th inch to $\frac{1}{4}$th inch be that given in millimetres in column V., the nearest thousandths of an inch being given in column II.; these diameters being the series calculated by making P, in the formula $\text{D} = 6\,\text{P}^{6}$, have in succession the following values:—

1 (or $0{\cdot}9^{0}$) mm.; $0{\cdot}9^{1}$ mm.; $0{\cdot}9^{2}$ mm.; $0{\cdot}9^{3}$ mm.; . . . . . $0{\cdot}9^{n}$ mm. Only two significant figures are taken to represent the diameters.

(2) That the pitches of these screws be the above gradually decreasing series, each pitch being $\frac{9}{10}$ths of its predecessor, but that only two significant figures be used in their expression. The series thus obtained is given in column VI.

(3) That in view of the desirability of securing a system of small screws, international in its character, English manufacturers of screws, screw-plates, &c., adopt the exact pitches given in millimetres in column VI., which, as explained in par. 9, can, if required, be originated on an English lathe. Further, in view of the fact that small screws and screw-plates, while nominally alike, will not unfrequently differ considerably as regards their number of threads per inch, the practice of designating such screws by their number of threads per inch should not be adopted. For reference, however, the approximate number of threads per inch, as calculated from the pitch given in column VI., are given in column IV.

(4) That the designating numbers given in column I., being the indices of the powers to which 0·9 is raised to obtain the pitch, be punched against each hole in the screw-plate, and that, if thought desirable, its diameter in thousandths of an inch (column II.) might be punched side by side with this number.

25. In his *Systématique des vis Horlogères*, Prof. Thury has done for the small screws used by watch, clock, and scientific instrument makers what was done 40 years ago by Sir J. Whitworth for the larger screws used by engineers; and, like the admirable system introduced by the latter, the scheme here advocated is based on the data obtained by measuring the several dimensions of many screws accepted by practical men as being well-proportioned.

26. The committee has had an opportunity of examining both screws and screw-plates (for the smaller screws) made on this system, which it is convinced will satisfy all the demands of practice. The committee can, therefore, confidently recommend its adoption by the British Association, subject to the slight modification discussed in par. 23; and it feels that an important incidental advantage would be the support it would at once receive on the Continent, and the consequent increased rapidity with which it might be expected to come into general use; for it cannot be doubted that its recognition by so important a body as the British Association would have considerable influence in establishing the system abroad.

[The recommendation for the appointment of this committee having failed to reach the Committee of Recommendations at Southport in time to allow of its sanction by the General Committee, the Council at their meeting on November 6th, 1883, requested the committee to continue their labours, and undertook to recommend to the General Committee at Montreal that this report be printed among the reports.]

THE WATT AND HORSE-POWER.

By W. H. PREECE, F.R.S., read before the British Association September 1, 1884.

THE most useful practical unit in use among electricians that has been derived from the C.G.S. system of absolute measurement is probably the Watt, or the rate of doing work, when a current of 1 ampère is maintained through a resistance of 1 ohm. The work done by an electric current is thus brought into intimate relation with all other kinds of work. The common gravitation unit rate of working is the horse-power, which is 550 foot-pounds per second. The absolute C.G.S. unit is the erg per second, or the work done in one second in overcoming the force of one dyne through a distance of one centimetre. In any electrical measurement the electromotive force (E) in volts multiplied by the current (C) in ampères gives a product (E C) equivalent to so many 10^{7} ergs per second which is the watt.

There are 746 watts in a horse-power, and E C is reduced to horse-power by dividing it by 746. The rate at which electrical energy is developed or expressed in any part of any circuit is given in watts when we multiply the number of volts by the number of ampères.

Strange mistakes are made in confusing the unit of power with the unit of work. No less an authority than Prof. Adams in his inaugural address as President of the Society of Telegraph Engineers and Electricians spoke of the watt as the unit of work, and gave its value.

According to Prof. Dewar, a standard sperm candle develops 240,000 foot-pounds per hour, or 4,000 foot-pounds per minute. Now since a watt is equivalent to 44·2 foot-pounds per minute, it follows that a standard candle develops 90 watts per minute. Again, according to the same authority, 5 cubic feet of coal gas in London develops 2,500,000 foot-pounds per hour or 41,666 foot-pounds per minute, or 2,976 foot-pounds per candle per minute, which is equivalent to 67 watts per minute.

A good glow lamp absorbs 2·5 watts per candle per minute, hence a glow lamp has an economy in energy of about 30 times that of a gas lamp and 40 times that of a standard sperm candle. A man working very hard expends about 100 watts per minute, and if a man-power is equal to say one standard candle, it is equal to 1·34 gas candles and 36 electric candles. What a field for economy in lighting, and how essential it is that gas should be applied to the production of power rather than to the production of light.

The horse-power as a unit has all the defects of an arbitrary unscientific standard. It involves the use of coefficients, and it is not connected directly with the absolute system of measurement; it differs in different parts of the world, and its name is misleading. It could be changed both in value and name without any inconvenience, except to those who are too familiar with the existing coefficients and formulæ. If its value were raised 34 per cent. it would become the kilowatt, and be connected directly with the C.G.S. system. It would then become a scientific system, and diminish the use of coefficients. Even the present name could be retained and its value altered from 746 to 1,000 watts, or from 30,000 foot-pounds to 44,233 foot-pounds per minute without any serious inconvenience. Existing numbers expressing horse-power would simply have to be multiplied by 746 to bring them to the value of the new unit.

Or numbers in the new unit would have to be multiplied by 1·34 to express their value in the old system.

I cannot help thinking that the good work of the B. A. Committee will not be complete until the C.G.S. system is authoritatively applied to work and power. The following table brings together nearly, if not all, the units in common use :—

Horse-power	...	33,000 foot-pounds per minute.
„ „	...	550 foot-pounds per second.
„ „	...	75·9 kilogrammetres per second.
„ „	...	1·01385 force de cheval.
„ „	...	746 × 10^7 ergs per second.
„ „	...	746 watts.
Force de Cheval	...	75 kilogrammetres per second.
„ „	...	542·48 foot-pounds per second.
„ „	...	0·9863 horse-power.
„ „	...	736 watts.
Watt ...	...	·0013405 horse-power.
„ ...	...	·736 foot-pounds per second.
„ ...	...	·1029 kilogrammetres per second.
„ ...	...	10^7 ergs per second.

DUST.

In the course of a lecture by Professor O. J. Lodge, delivered before the British Association on the evening of Friday, August 29, 1884, the lecturer remarked :

The most powerful and rapid way of clearing air was by electrifying it, and it was shown how quickly a point discharge could clear air of thick smoke.

Electrification of Fog

turns it into Scotch mist and rain, and this fact bore a close relation to the violence of thunder showers. A hope was expressed that fog might, perhaps, prove amenable to this treatment. In coming to this country some of the members of the association lay for some hours outside the Straits of Belle Isle in the midst of icebergs mingled with fog. Electric light is powerless to penetrate it, and it was impossible, as they lay there idle, not to be struck with the advisability of dissipating it. It was rash to predict what could be done; it was still rasher to predict what could not. He would merely point out that on board a steamer are engines; that these engines can drive a very powerful Holtz machine, one pole of which may be led to points on the masts. When electricity is discharged into fog on a small scale it coagulates into globules and falls as rain; perhaps it will on a large scale, too. Oil stills the ripples of a pond, and it has an effect on the ocean billows; just so an electric discharge, which certainly coagulates and precipitates a smoke or fog in a bell jar, may possibly have an effect on an Atlantic fog. He was not too sanguine, but it would not cost much to try, and even if it only kept a fairly clear space in front of the ship, it would be useful. There were other applications of this electrical clearing or deposition of dust, one of which he knew was being tried on a fairly large scale, but he was not here to talk of practical applications, but of science itself. A homely proverb might be paraphrased into a useful motto for young investigators, 'Stick to the pure science, and the applications will take care of themselves.' He was not one to deny the application of science to the benefit of mankind—far from it; but while the rewards of industrial application were obvious and material, and such as would always secure an adequate following, the rewards of the pursuit of science for its own sake, were transcendental and immaterial, and not to be imagined except by the few called to the work. That call entailed labour and self-sacrifice beyond most other, but those who received it would neglect it at their peril.

MAGNETIC ROTATION OF COMPOUNDS.

By Dr. Perkin.

(Read before the Chemical Section of the British Association, August 29th, 1884.)

The author gave a *résumé* of his research on the magnetic rotary polarisation of chemical compounds. The pure liquids were placed between the poles of a powerful electro-magnet, in which the direction of the current could be easily reversed. In order to make the results with different substances comparable, the results were calculated for such a length of column of each liquid as would be formed by the condensation of a unit-length of its vapour. Dr. Perkin showed that the specific rotary power of an atom is a physical constant, which gives chemists another independent method of determining the constitution of substances of equal value to the methods founded on determination of specific volumes and refractive indices. The numbers calculated from the "series constants" compared with the actually found exhibit in a great many cases a satisfactory agreement.

ON A GALVANOMETER WITH TWENTY WIRES.

By Lord Rayleigh.

(Read before the British Association, August 29th, 1884.)

The author has designed a galvanometer to meet a difficulty met with when strong electric currents are used. It is a differential instrument, and may be regarded as a differential galvanometer. He takes twenty pieces of wire from one hank, each about eight feet in length, and twists these in ten pairs, the twisting being done conveniently by a lathe, and again twists them into a rope of about eight feet in length. This is then bent into a circle, in the centre of which the magnetic needle is suspended. There are two electrical circuits, each of ten wires, the one of ten wires joined in parallel, and the other of ten wires joined up in series. Now, as the current is passed through the series coil in the opposite direction to that in which it flows in the parallel wires, and as the parallel wires can be used from one to ten, the ratio can be made anything, from even ten to one.

Sir W. Thomson after the reading of the paper stated that he had himself been engaged for four years in trying to devise a satisfactory galvanometer which would measure from the one-millionth of an ampère to 100 ampères, and congratulated Lord Rayleigh not only in proposing to make his galvanometer, but in having made an actual instrument.

ON TELEPHONING THROUGH A CABLE.

By Lord Rayleigh.

(Read before the British Association, August 29th, 1884.)

Lord Rayleigh showed that the intensity of sounds was modified by distance, and that the law was expressed by the formula—

$$v = \varepsilon \sqrt{\frac{n}{2\,k}} . x \times \cos. \left(n\,t - \sqrt{\frac{n}{2\,k}}, x \right).$$

He adduced the case of the Atlantic cable, and showed that speech was scarcely possible beyond 20 miles.

Mr. Preece mentioned that he had experimented on several cables to determine this distance, and that his practical results very closely agreed with Lord Rayleigh's theoretical calculations. It was scarcely possible to speak on underground wires further than 12 miles. He had, however, spoken between Dublin and Holyhead, a distance of 60 miles. He described how induction was perfectly cured by using two wires in metallic circuit and twisting around each other.

Prof. Graham Bell, who on rising was received with applause, said he considered the subject of great interest, and expressed himself as very much interested in the discussion.

Mr. Preece said that by using an artificial resistance of 2,000 or 3,000 miles he could not speak at all through a cable.

Dr. Traill, of Dublin, suggested the continuation of experiments in the direction indicated and the resumption of the discussion next year.

ON THE LAW REGULATING THE CONNECTION BETWEEN CURRENT AND INTENSITY OF INCANDESCENCE OF CARBON FILAMENT IN GLOW LAMPS.

By Mr. W. H. Preece, F.R.S.

(Read before the British Association, September 1st, 1884.)

In a paper read before the Royal Society in 1883, I pointed out from experimental data that the light emitted by a glow lamp apparently varied as the sixth power of the current.

I have verified this law, not only by subsequent experiments of my own, but, which is much more satisfactory, by experiments of others. Prof. Kittler, of Darmstadt, and Capt. Abney have made, independently of each other, most careful and exhaustive measurements. I have tabulated and plotted them out in curves, which I submit. They fully confirm the law that

$$L = K C^6,$$

but within limits, and that these limits embrace the ordinary range of a glow lamp when used for artificial illumination, as long as the resistance and the current vary uniformly together, the law holds good; but as the state of incandescence is increased, a point is reached varying with each kind of lamp when the resistance ceases to diminish at the same rate, and eventually to increase. When this occurs the law is departed from, and the light emitted increases much faster than the sixth power of the current. The filament speedily breaks. The point of departure from the law indicates a point when a change of state occurs in the carbon filament. Disintegration probably sets in. This point ought to be determined for each kind of lamp, and it should never be allowed to be reached, for it is from this point that the decay commences and rupture follows.

IMPROVEMENTS IN COAST SIGNALS.

By Sir James Douglas.

(Read before the British Association, September 1st, 1884.)

The author, in the course of a lengthy paper, which referred to lighthouse signalling generally, mentioned the electric light in connection therewith favourably where high powers were used, on account of the intensity and consequent penetration. He also alluded to the experiments, being at present made in England, with both oil and electric lights, and said that the results were looked forward to with very great interest. In speaking of flashing and fixed lights, he said that probably in the course of one year there would not be a single fixed light left in the signal service.

Sir W. Thomson opened the discussion, and argued in favour of short intervals of time in flashing, and also modifications in the mode of using the siren so as to be able to make the signals quicker and more distinct by varying the pitch of the alternating signals.

Mr. Harcourt dissented from the propositions of Sir W. Thomson as to brief varied sound signals, and afterwards referred to the subject of the advantages of multiple lights in regard to penetration. He said that the electric light was very far superior in clear weather, but that in foggy weather the relative loss of electric light as compared with oil lights was very great.

Dr. J. H. Gladstone expressed his gratification that fixed lights are to be abolished.

INDUCTION INCLINOMETER.

By Mr. C. Carpmael, read before the British Association September 1, 1884.

The instrument is a modification of Lloyd's induction inclinometer, the modifications consisting in:—1. The substitution of a bifilar for a unifilar suspension. 2. The placing of the induction bars at such distance apart that, when the dip has approximately its mean value at the place, the suspended magnet may be in equilibrium at right angles to the magnetic meridian, under the action of the magnetic forces alone, the torsional force of the suspension threads having been made to vanish in that position. With this arrangement, if the *permanent* magnetism of the induction bars is eliminated, the reading in the mean position is unaffected by changes in the total force, which will, however, affect the scale coefficient. Except in great disturbances, therefore, no correction for force need be applied. Small changes in declination will not affect the readings, so that the instrument is well adapted for photographic registration of changes of the dip. By a simple mechanical arrangement the effect of changes of temperature may be eliminated. A method of adjusting the instrument and of determining the scale coefficient is given. If possible, photographic records of the instrument will be added, with a comparison between them and those of other instruments.

ON AN ANALOGY BETWEEN HEAT AND ELECTRICITY.

By Geo. Fras. Fitzgerald, Trinity College, Dublin.

The object of this communication was to point out the analogy that may be drawn between quantity of electricity and quantity of eutropy when electric potential is considered as analogous to temperature. A non-conductor of electricity would be a non-conductor of eutropy, which is the same as a non-conductor of heat. A conductor would be a heat engine in which the fall of temperature of the eutropy was completely utilised.

It was pointed out that a molecular structure of the ether could be assumed which would not conduct heat as material gases do, but which might be thrown by differences of temperature into the state of stress that explains electrostatic phenomena. It was explained that this was a step beyond that made by Maxwell in his "Electricity and Magnetism" where he avoids any hypothesis as to how electric displacement produces mechanical stress. In was on the other hand explained that the principal object of this communication was not to bring forward this very doubtful hypothesis, but to point out that the analogy of electric currents and displacements to the motions of an incompressible fluid was by no means the only one that could be drawn, and by pointing this out to obviate the danger at present imminent of this mere analogy being considered as a likeness.

ON CLARK'S STANDARD CELLS.

By Lord Rayleigh, read before the British Association, September 2, 1884.

In the hope of finding a clue as to the origin of some of the minor anomalies of the Clark cells, I have made experiments upon the E.M.F. of combinations in which two different strengths of zinc amalgams take the place of the zinc and pure mercury of the Clark cell. No mercurous sulphate is employed, the liquid being simply a saturated solution of zinc sulphate.

If the same kind of amalgam be used for both poles the symmetry is complete, and there should be no E.M.F. But if we take for one pole a strong, but fluid amalgam, and for the other the same amalgam diluted with an equal volume of pure mercury we find a very sensible E.M.F., the strong amalgam corresponding to the zinc of the ordinary Clark. In my experiment the E.M.F. was ·004 Clark, which remained pretty constant from day to day. In another cell the same strong amalgam was used for one pole, and for the other pole was diluted with three times its volume of pure mercury. In this case the E.M.F. was ·009 Clark. If we replace the diluted amalgam with pure mercury, we obtain (withour mercurous sulphate) nearly the full E.M.F of the Clark cell, but, as might be expected, the force is very unsteady. From this it would seem that the function of the mercurous sulphate in the usual form of cells is to retain the purity of the mercury, and that the E.M.F. is largely due to the affinity of mercury for the zinc.

ATMOSPHERIC ELECTRICITY.

At the present time there is no satisfactory theory of the source of atmospheric electricity. Many believe, in the absence of positive evidence of the production of electricity by the operation of evaporation and condensation, that the earth has a definite charge, which resulted from the operations at its birth, and which it has kept undiminished in amount; and that thunderstorms are merely the expression of local accumulation due to currents of air.

Mr. G. Le Goarant de Tromelin, in a late number of the *Comptes Rendus*, advances the opinion that atmospheric electricity is due to the friction of the air, humid or dry, upon the surface of land or water, and calls attention to Armstrong's hydro-electric machine, which produced electricity of high tension by the friction of jets of steam in issuing from narrow orifices. According to Tromelin, the wind, in skimming over the surface of water, carries water from the crests of the waves, which play the part of the comb of Armstrong's machine. The roughness of the soil does the same on land when a damp wind passes over it. The charge thus produced is collected upon the vesicles of clouds. The potential energy of a cloud depends upon its configuration and its temperature. If this configuration changes under the effect of condensation or congelation of the aqueous particles, the cloud absorbs a certain amount of energy, which must be found again under the form of an augmentation of potential energy: hence there is an electrical interchange constantly going on in the cloud region of the air; and when these changes are rapid, and great in amount, we have thunderstorms and other great electrical manifestations.

The advocates of Mr. Tromelin's views can point to the effect of the blasts of sand driven by the wind upon the pyramids, and to the extraordinary electrical manifestations upon high peaks in Colorado, where every *aiguille* seems to hiss, at times, with the escaping electrical charge.

We believe that the time has arrived when the scientific world no longer looks upon electrical phenomena as isolated and separate from the phenomena of heat and light, or chemical reactions. We cannot believe that any change can take place in the arrangement and mutual attractions of molecules without electrical manifestations. If we are to have a thermal chemistry, we must also have an electrical chemistry; and the history of the energy of a chemical reaction is not completely told when we sum up the heat of this reaction, unless we count also the heat-equivalent of the resulting electrical changes. If we were, therefore, to frame a theory of atmospheric electricity, we should begin it with the assertion that every change in the configuration or arrangement of particles of matter is accompanied by an electrical disturbance; and, as far as this assertion goes, all the present theories of atmospheric electricity would fall under it as special cases.

The object of this paper, however, is not to frame hypotheses, but to trace the recent work which has been done in systematic observation of atmospheric electricity. It is only to systematic observation that we can evidently look for information which will be of immediate practical value to our signal-service. Unfortunately, no systematic observations have been made for any length of time in any country.

The electrical conference at Paris, held last April, was adjourned from a meeting of the previous year; and committees were appointed to study the subject of atmospheric electricity and earth-currents in different countries. The time was evidently too short for such a stupendous undertaking; but the conference did valuable work in stimulating systematic observation, and creating a bureau at Berne, to which it was recommended that observations made in different countries should be sent. The agitation of the subject of such observations called forth several papers. Prof. Ròiti of Florence presented to the conference the result of observations made through several months with a self-registering apparatus. He found that the zero of Mascart's electrometer changed from time to time, and traced this change to the mechanical effect of the sulphuric acid upon the platinum wire connected with the electrometer needle. He therefore dispensed with the Leyden jar of the Thomson and the Mascart electrometer, and suspended the needle by a very fine silver wire which was connected directly to the positive pole of a water-battery of many cells. This instrument was found to work well. Prof. Ròiti believes that local disturbances have great effect, and that these local effects must be carefully taken into account in comparing simultaneous observations over large areas.

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Prof. Palmieri's methods and instruments do not impress us very favourably. There must be great difficulty in insuring good insulation by his method of suddenly elevating a disc in the air. Moreover, his theory of induction does not appear to us to be well founded. The Thomson method of observing atmospheric electricity seems to promise better results than any other; yet it is not by any means perfect, especially in its practical adaptation to the needs of a government signal service. The experiments which are being conducted at the physical laboratory of Harvard College show that in the American climate it is extremely difficult to secure a regular flow of water from the water-dropper, and to obtain good insulation, on account of frost and snow. During the months which are free from snow and ice, heavy showers wet the insulating stand of the water-dropper, and thus destroy the insulation. The latter evil can be obviated to some degree by a well-constructed screen of wood. It has been found preferable to neglect the insulation of the can, and allow the drops of water to fall upon a metallic plate, thrust out from the side of the room in which the electrometer is situated, by means of a glass cylinder, through the centre of which runs a wire which connects the metallic plate with the electrometer. The drops of water fall, in turn, from the metallic plate, and reduce this to the potential of the air, while the insulation of the metallic disc can be perfectly maintained in all weathers. Preliminary experiments have also been made upon an arrangement, which promises to be of use in winter, when the weather would prevent the use of the water-dropper. This arrangement consists merely of a wheel provided with metallic brushes. The wheel is run rapidly by simple clock-work, and is insulated. The brushes touch one end of an insulated conductor exposed to the air, and then touch a conductor connected with the earth, in this way imitating the action of the water-dropper. An arrangement of this kind, which will work in all changes of weather, is essential in the climate of the United States.

The preliminary experiments at the laboratory of Harvard College have also shown that it is essential that the electrometer should not be very distant from the water-dropper or its equivalent. A naked iron wire connected the electrometer with a water-dropper, which was about 300 feet distant, at the top of a building, and at least 60 feet from the ground. The photographic record of the excursions of the electrometer needle showed that it moved irregularly to and fro under the influence of the fluctuation of potential along the wire. There is evidently a certain relation between the size of the conductor, which is reduced to the potential of the air by the succession of water-drops, and the number of orifices from which the water must issue in order to reduce the conductor and connecting wire to the potential of the air.

The photographic records that have been made show unmistakeably that north-west winds in the colder months are preceeded by a rise in the electrical potential of the air, and that during an east wind the potential falls. These general indications seem to be independent of local effects, and lead us to believe that electrical signal station observations will be useful in predicting changes of weather. Photographs of the varying electrical state of the air could be forwarded to Washington from different stations, and a map could be made on which stations at the same electrical potential could be connected; and thus any law connecting the electrical state of the atmosphere with other meteorological changes could probably be ascertained. Much remains to be done, however, in ascertaining the best position for such signal stations, and in perfecting simple and practical apparatus for the use of comparatively unskilled observers. — JOHN TROWBRIDGE, in *Science.*

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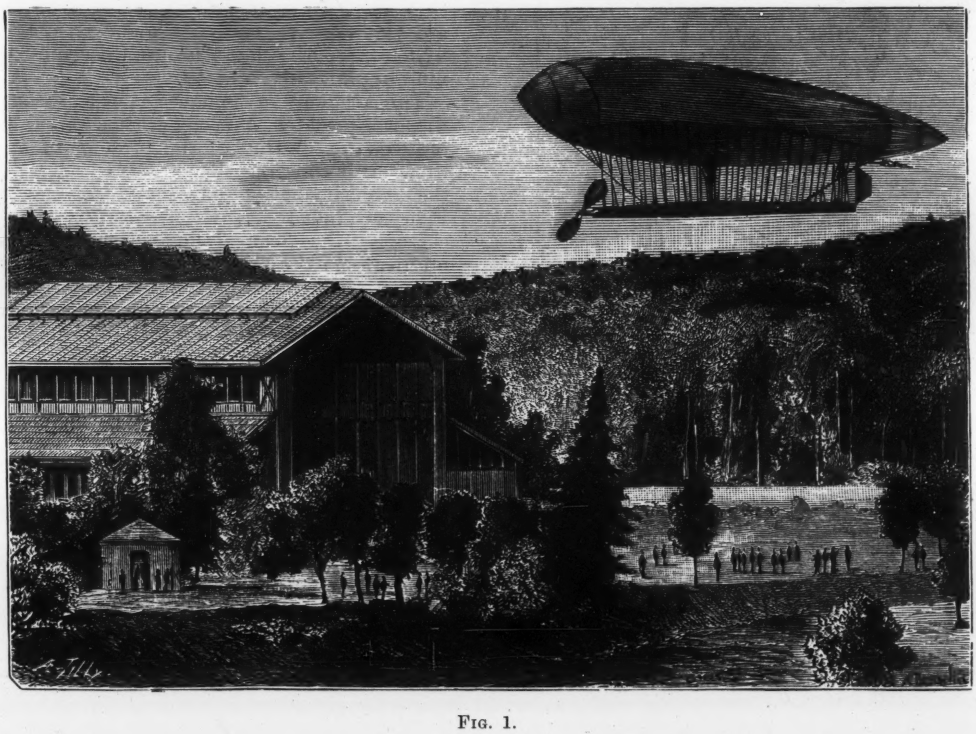
The carrying out of this programme, and its attendant investigations, have been made by both gentlemen ; but the study of the special arrangement of the suspending cords, the determination of the volume of the balloon, the arrangements for ensuring the longitudinal stability of the balloon, the calculations of the dimensions to be given to the parts of the car ; and, lastly, the invention and construction of a new battery of exceptional power and lightness, which is one of the essential parts of the system, are the personal work of M. Renard.



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The various details of construction of the balloon, its mode of connection with the suspending cords, the system of construction of the screw and the rudder, the study of the electric motor, calculated according to a new method based upon preliminary experiments, allowing the determination of all the elements for a given power, are the work of M. Krebs, who, by means of special arrangements, has succeeded in making the apparatus unusually light.

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The quantities indicated by these two methods agree very closely, and show that, to obtain a speed of 8 to 9 metres per second, a useful tractive force of 5-H.P. is required ; or, taking into account the rendering of the screw and the machine, an electric work sensibly double, measured at the terminals of the machine.

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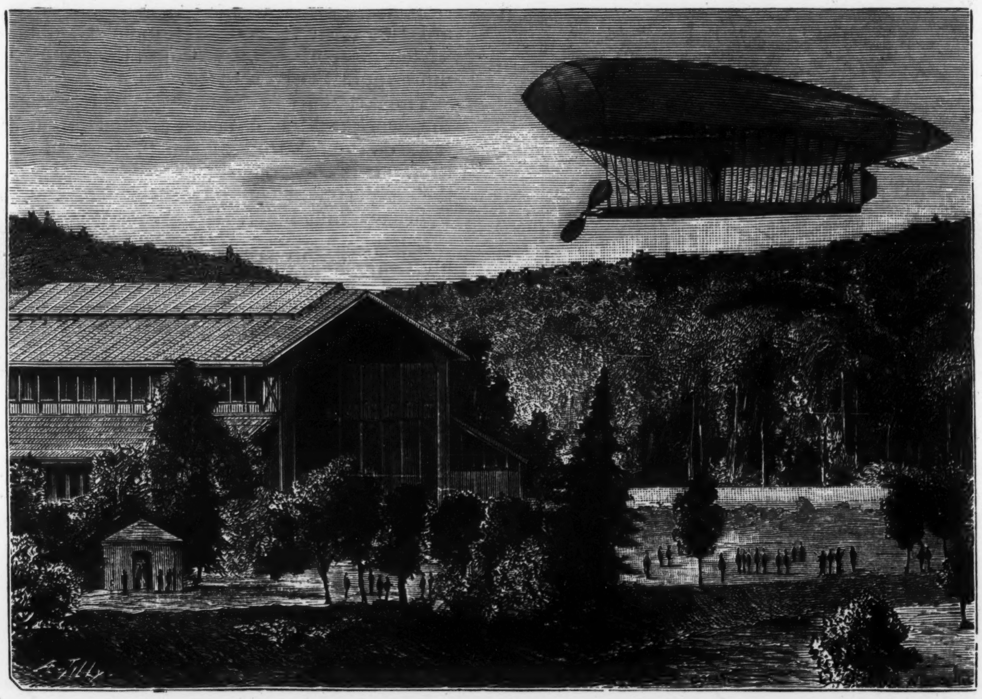

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The route was first kept from north to south, over the plateau de Châtillon et de Verrières, as far as the road from Choisy to Versailles, and in order to avoid some trees, the direction was altered, and the head of the balloon directed towards Versailles.

At Villaconblay, finding themselves about 4 kilometres from Chalais, and being completely satisfied with the working of the balloon, the aeronauts decided to retrace their steps and to attempt to descend at Chalais, notwithstanding the small space left free from trees. The balloon turned half-way round to the right by a very slight alteration of the angle (about 11°) of the rudder. The diameter of the circle described was about 300 metres. Taking as a guide the dome of the *Invalides*, Chalais was passed a little to the left.

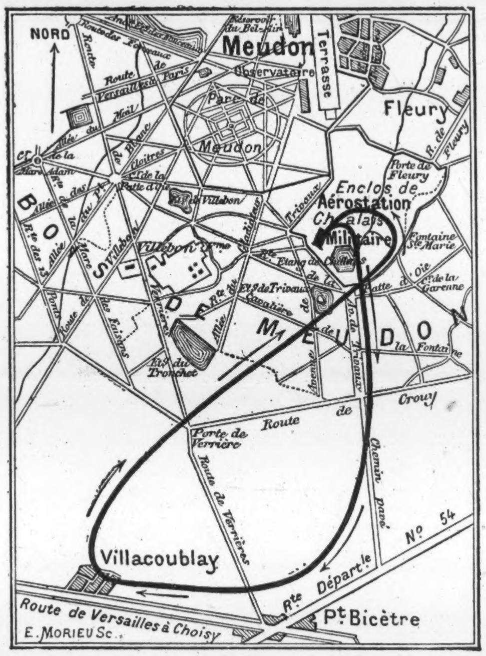


FIG. 2

Arrived at this point, the balloon, with as much ease as before, altered its course to the left, and soon reached its point of departure, at a height of 300 metres. It was now caused to descend by manipulation of the valve. During the descent it was necessary several times to propel the balloon ahead or astern, in order to keep it over the place selected for landing.

At the height of 80 metres a rope was lowered from the balloon, which was by this means brought down in the same field from which it set off.

Distance covered, measured on the ground	7·600	km.
Time	23	min.
Mean speed per second	5·50	m.
Number of elements employed	32	
Electric power expended at terminals of motor	250	kgm.
Probable rendering of motor	0·70	„
„ „ „ screw	0·70	„
Total rendering about	½	
Tractive force...	123	kgm.
Approximate resistance of the balloon ...	22·800	kil.

Upon several occasions during the journey the balloon underwent oscillations of 2° to 3°, similar to the pitching of a ship. These oscillations may be attributed either to irregularities of form, or to local air currents in a vertical direction.

International Inventions Exhibition.—The latest date for sending in applications for space has been extended from the 1st of October to the 1st of November.

NOTE ON STEERABLE AEROSTATS.

By M. DUPUY DE LOME.

HAVING been detained at home by sickness I was not able, as I had hoped, to lay before the Academy an account of the brilliant result obtained in the experiment of aerial navigation made at Meudon, on August 9th, by Captains Renard and Krebs, by means of the screw aerostat, which they had constructed at the works of the War Department.

Our colleague, M. Hervé Mangon, has presented to the Academy an account of this fine experiment, by depositing at the office a memoir on the subject by MM. Renard and Krebs.

The object of the present note is merely to repeat the results of the ascent of August 9th, 1884. These will, however, be surpassed in future experiments which these same learned and persevering officers will soon make; trials in which they will urge the motor machine of their aerostat to a power more than double that employed on August 9th. They will thus reach a speed of about 25 kilometres per hour in still air.

What I think it suitable to recall on this occasion are the positive results previously obtained, and of which those of August 9th are the sequel, though with more rapidity given to the aerostat.

The Academy of Sciences is partly connected with the work which I accomplished in 1871 and 1872 towards the solution of the problem of aerial navigation. It is consequently interested in the features of the experiment of our screw aerostat, carried out February 2nd, 1872.

During the siege of Paris I had the honour to communicate to the Academy, October 10th, 1871, a plan for a screw aerostat moved by human power, capable of being steered with precision, and when worked by eight men of reaching a speed of 8 to 10 kilometres per hour in still air.

In consequence of this communication the Minister of Public Instruction, taking into consideration the favourable opinion manifested by the Academy, commissioned me to execute the vessel which I had in view, at the cost of the State.

I repeat that I have been powerfully aided in this work by my friend and former colleague in the direction of naval materials, M. Zédé, and by the aeronaut M. Yon, who gave me the precious assistance of his practical knowledge.

The difficulty of procuring the desired materials in Paris during the siege, and that of finding a suitable place for the preparation of the departure of this aerostat, and, lastly, the terrible events of 1871, prevented us from proceeding with the ascent until February 2nd, 1872.

There blew that day, over Paris, a very strong south wind, the velocity of which was about 15 metres per second, or 54 kilometres per hour.

After so many delays already encountered, it would have been better to await more favourable weather, but being repeatedly pressed by the War Department to give back to their use the space which the aerostat occupied in the fort of Vincennes, I decided, without further delay, to make the ascent for which everything was prepared.

I took this resolution in spite of the high wind of that day, confident that the facilities which the arrangements of the aerostat afforded would enable us to effect a descent without danger either to the apparatus or to my numerous companions who, with myself, made up a crew of 14 men in the boat. I was equally certain that the wind would not hinder us in our experiments on turning or in keeping in the direction of the longitudinal axis of the aerostat; that it would not prevent us from reaching our due speed with reference to the still air, and that, in short, the high wind would have no unpleasant effect beyond preventing us from returning the same day to our starting point, as we should have done in calm weather, or with only a gentle wind.

The principles of construction of this screw aerostat, as well as the results attained in the ascent of February 2nd, 1872, are given in detail in my memoir to the Academy of Sciences, with all the plans appended to the text, and also in the report of the official commission nominated by the Minister of Public Instruction to give an account of this experiment.

As for the results obtained with this screw aerostat, they have been entirely conformable to my provisions as is proclaimed in the report of the commission above mentioned.

The stability and the obedience to the helm were perfect; the speed of the aerostat with reference to the still air was 2·80 metres per second, or 10 kilometres per hour, with eight men working the screw. This speed enabled us to deviate at will to the right or the left from the direction of the wind, following an angle resulting from the two velocities combined; but it was quite insufficient for us to return the same day to our point of departure against a current of air of 54 kilometres per hour with reference to the ground, since we had at our disposal a speed of only 10 kilometres in the air.

We were therefore obliged to descend after an aerial navigation of two hours. The descent, notwithstanding the force of the wind, was effected with the greatest ease and without damaging any part of the apparatus, all the portions of which were subsequently sent to the stores at Meudon.

In the conclusions of my memoir to the Academy of Sciences, as well as in those of the Report of the Commission, it is stated that by substituting for the eight men employed to turn the screw, a gas or hot-air engine, we might easily obtain, for the same weight, a motive power of about eight horse-power and that then the speed of the same aerostat would reach 22 kilometres hourly in place of 10.

In the discourse which I pronounced at Annonay, in the name of the Academy of Sciences, August 13th, 1883, at the inauguration of the monument erected to the brothers Montgolfier, I was naturally led to give a summary exposition of the state of the art of aerial navigation. I cited the studies on this subject of Joseph Montgolfier himself, of Blanchard, of Guyton de Morveau, of Meusnier, of Marey-Monge and of Henry Giffard (MM. Tissandier had not at that date made their attempt of October, 1883), then, after having recalled my own attempts and my ascent of February 2nd, 1872, I added:—"Compelled to give my time to other duties from which I cannot withdraw myself, I have seen with pleasure the continuation of the enterprise of a steerable aerostat entrusted by the Minister of War to very competent officers, who are working eagerly at Meudon. They already possess a light and powerful motor, constructed by them with admirable skill and perseverance, and I am convinced that they will arrive at an early solution of the problem of aerial navigation with a velocity of movement which will render it practical."

The brilliant experiment effected on the 9th of this month by MM. Renard and Krebs, proves that I was not mistaken in thus asserting that their success was near at hand. They have created for aerial navigation a most remarkable dynamo-machine, impelled by a special battery. With a total weight of 560 kilos. (machine, battery and liquid), this motor can develop eight horse-power for four hours.

Such is the considerable result, which does them the greatest honour. They have applied this dynamo to a screw-aerostat, executed according to all the principles established in my memoir to the Academy, and also in the Report of the Commission on the experiment of February 2nd, 1872. MM. Renard and Krebs have often spoken of these two documents as the fundamental bases which they have adopted in the construction of the screw-aerostat destined to receive their new motive machine. It seems to me, nevertheless, in presence of assertions which were made in the session of Monday last, that I owe it to myself and my colleagues, that I owe it to the Academy of Sciences, which patronised my project of a screw-aerostat in 1871, as well as to the Minister af Public Instruction, who rendered its execution possible by his financial assistance, to recall the exact results of direction and speed obtained by our screw-aerostat on February 2nd, 1872.

The power of steering and the velocity of this apparatus—of 10 kilometres hourly with reference to the air—would have perfectly enabled us to return to the ground within the fort of Vincennes after having made an excursion outside, if on that day, as on August 9th, 1884, there had been merely a gentle breeze, of sufficiently less than 10 kilometres per hour. MM. Renard and Krebs, with their present aerostat, returned very easily on August 9th to their starting-point, because the wind was very gentle. They would still have been able to return, even with a stronger wind, so long as its velocity did not approach too closely on 19 kilometres—the speed of their aerostat. They are about to render it more rapid—about 25 kilometres—which will drive back so far the limit of the speed of the wind which prevents return.

Such is the progress effected by these officers, but it is incorrect to say that there has not existed previously an aerostat capable of being steered.

What was accomplished on August 9th was a progress in speed, from 10 to 19 kilometres hourly, by means of an electro-motor very powerful for its weight. —*Comptes Rendus.*

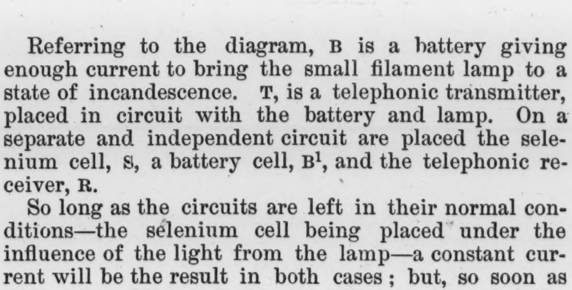
THE CORRELATION OF PHYSICAL FORCES.

[A COMMUNICATION.]

I VENTURE to submit to the notice of your readers an experiment which, not being in a position to carry out for myself, might be of sufficient interest from a scientific point of view to induce some ardent devotee of science to carry out.

To the best of my knowledge this conception has not previously been brought forward.

By the aid of a current of electricity heat is produced to the extent of giving light which, in its turn, shall be so utilised as to reproduce speech, and this I propose to accomplish in the following manner:—



Referring to the diagram, B is a battery giving enough current to bring the small filament lamp to a state of incandescence. T, is a telephonic transmitter, placed in circuit with the battery and lamp. On a separate and independent circuit are placed the selenium cell, S, a battery cell, B^1, and the telephonic receiver, R.

So long as the circuits are left in their normal conditions—the selenium cell being placed under the influence of the light from the lamp—a constant current will be the result in both cases; but, so soon as the operator begins speaking to the transmitter, T, the current strength will vary, and the luminosity of the lamp, L, will be subject to continual change.

This variation in the light will in turn alter the resistance of the selenium cell, and the current flowing through the receiver, R, will vary in like manner. Thus it appears possible to transmit speech through the media of an incandescence electric lamp and a selenium cell; the telephonic transmitter being placed in circuit with the one, and the receiver being connected with the other, both circuits, however, being absolutely separated.

Whether any practical outcome will result from this suggested experiment I cannot say, but I thought it might be considered as possessing enough scientific interest to figure as a contribution for illustrating in some slight degree the correlation of physical forces.

"MUSICUS."

STATISTICS OF THE TELEPHONE SYSTEM.*

OUR readers will find below the first table of information upon the progress of the European telephonic installations, including England, Belgium, France and Italy. The most summary examination will show the rapid and considerable progress which this industry continues to make in Europe.

NAMES OF COMPANIES.	TOWNS.	NUMBER OF SUBSCRIBERS IN 1883.	NUMBER OF SUBSCRIBERS IN 1884.	INCREASE.
	ITALY.			
Societa Telefonica Lombarda	Milan	520 to the 30th June, 1883	1,052 to the 31st July, 1884	532 in 13 months
Societa Telefonica per l'Italia centrale	Florence ...	513 to the 30th June, 1883	733 to the 31st July, 1884	220 in 13 months
„ „ „	Bologne... ...	312 „ „ „	427 „ „ „	115 „
„ „ „	Livourne ...	231 „ „ „	310 „ „ „	79 „
		1,056	1,470	414
Societa generale Italiana di Telefoni ...	Venice	185 to the 30th June, 1883	190 to the 31st July, 1884	5 in 13 months
„ „ ...	Rome	939 „ „ „	1,325 „ „ „	386 „
„ „ ...	Naples	525 „ „ „	641 „ „ „	116 „
„ „ ...	Palermo ...	246 „ „ „	320 „ „ „	74 „
„ „ ...	Messine... ...	114 „ „ „	124 „ „ „	10 „
„ „ ...	Catane	125 „ „ „	179 „ „ „	54 „
		2,134	2,779	645
	FRANCE.			
Société générale des Téléphones... ...	Paris	2,992 to the 4th Sept., 1883	3,563 to the 4th Sept., 1884	571 in one year
„ „	Alger	18 „ „ „	22 „ „ „	4 „
„ „	Bordeaux ...	280 „ „ „	322 „ „ „	42 „
„ „	Le Havre ...	191 „ „ „	198 „ „ „	7 „
„ „	Lille	128 „ „ „	146 „ „ „	18 „
„ „	Lyon	528 „ „ „	563 „ „ „	35 „
„ „	Marseille ...	336 „ „ „	380 „ „ „	44 „
„ „	Nantes	89 „ „ „	92 „ „ „	3 „
„ „	Oran	30 „ „ „	48 „ „ „	18 „
„ „	Rouen	62 „ „ „	96 „ „ „	34 „
„ „	St.Pierre-Calais	85 „ „ „	105 „ „ „	20 „
		4,739	5,535	796
	BELGIUM.			
Compagnie belge du Téléphone Bell ...	Bruxelles ...	556 to the 15th Dec., 1883	631 to the 31st July, 1884	75 in 6½ months
„ „ ...	Anvers	748 „ „ „	794 „ „ „	46 „
„ „ ...	Charleroi ...	208 „ „ „	188 „ „ „	less 20
„ „ ...	Gand	272 „ „ „	318 „ „ „	46 in 6½ months
„ „ ...	Verviers ...	256 „ „ „	303 „ „ „	47 „
		2,040	2,234	194
	GREAT BRITAIN.			
United Telephone Co.	London	2,565 to the 30th April, 1883	3,350 to the 30th April, 1884	785 in one year
Lancashire and Cheshire Telephone Co.	Liverpool, Manchester, Southport, Blackburn, &c. ...	2,359 to the 30th June, 1883	2,734 to the 30th June, 1884	475 in one year

In Italy (where we still lack statistics of Turin and Genoa) out of a total of 5,301 subscribers, 1,591, or 30 per cent., have been added during the last thirteen months.

In France the progress for the year is 15 per cent., or 796 to 5,535. In Belgium the progress is only 9 per cent., 194 to 2,284, but it must be remembered that this is only taken upon six months and a half.

In England the progress is :—at London, 25 per cent., 785 to 3,350 ; at Liverpool and Manchester, 17 per cent., 475 to a total of 2,734.

ELECTRICITY CLASSES.

(*Continued from page* 212.)

Royal College of Science for Ireland, Dublin.—The department of experimental physics, under the direction of Prof. W. F. Barrett, F.R.S.E., M.R.I.A., &c., includes a comprehensive course of lectures to be delivered at 11 o'clock on five days of each week, from February to May. In addition to the lectures on electricity and magnetism in this series, a special course on applied electricity, consisting both of lectures and laboratory demonstrations, will be given in the first term on Mondays, Wednesdays, and Saturdays, from 12 till 2 o'clock. In this course electricity will be dealt with in its practical application and as a source of economic energy rather than as a branch of theoretical physics. The subjects embraced will be the production and measurement of electric currents, the total energy of electric circuits, and the proportion of it which may be made available under certain conditions. Dynamo-electric machines and their efficiency. The storage of electric energy, and the use and efficiency of storage cells. The conditions of greatest economy in the electric transmission of mechanical energy, such as that of winds, tides, and cataracts, and the possible larger utilisation of these and other sources of work. Electric lighting, telegraphy, and telephony will be an important part of the course, including the detection of faults, and the measurement of conductor and insulation resistances. Other applications of electricity, such as in synchronising clocks, firing mines, &c., will be illustrated. It is intended that the scope of this course should exhibit, as far as possible, the rapidly-increasing industrial applications of electricity, and aid the student in preparing for the many new careers in which a technical knowledge of electricity is indispensable. Practical work in the new physical laboratory will follow each lecture, so that a thorough acquaintance can be gained with the theory, construction, and use of electrical instruments. The fee for the entire course will be £4. The handbooks are S. Thompson's "Electricity and Magnetism," and Munro and Jamieson's "Electrician's Pocket-Book."

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* *Bulletin de la Compagnie Internationale des Téléphones.*

City of London College, White Street, Moorfields.—The new building, opened by the Prince of Wales in July last year, can accommodate 4,000 students. Magnetism and electricity classes are held on Wednesday evenings by Mr. J. Howard, F.C.S., and Mr. I. Scarf, F.C.S.; the fee for the course being 7s. 6d. Mr. J. C. Fell, M.I.M.E., also conducts a class of electrical engineering on Friday evenings at 7 o'clock, the fee for the course being £1 1s.

Yorkshire College, Leeds.—In the last annual report it is announced that the head of the physical department, Prof. Rücker, M.A., F.R.S., M.S.T.E., will be enabled, owing to the extra accommodation afforded in the new buildings, to offer his students additional advantages in the way of laboratory work. Special courses of study are being arranged for electrical engineers.

University College, Dundee.—Arrangements have been made by Prof. Steggall, M.A., and Prof. J. A. Ewing, B.Sc., F.R.S.E., for the giving of special instruction in electricity and its practical applications, to suit the requirements of students who wish to supplement their general engineering studies with a course of practical and technical electricity or to make electrical engineering a specialty, the course extending over two years. A special laboratory has been fitted out with the requirements for the practical teaching of electrical engineering. Students will be familiarised with practical methods of electrical testing, taught to measure the efficiency of dynamos, motors, and storage batteries, the ratio of candle-power to horse-power in electric lamps, the conductivity, insulation, and capacity of conductors, according to the methods practised in cable factories and telegraph stations, &c. Attendance in the laboratory is compulsory on all students of electrical engineering. The fee for the classes is 10s. 6d., and for the laboratory £4 4s. for the academic year, which commences 13th October and ends 27th June. There are also evening classes during the winter.

The Hammond Company Electrical Engineering College, London.—The membership of this college takes the form of a two years' apprenticeship to Mr. Robert Hammond, and the instruction by daily lectures and laboratory practice at the class-rooms in Red Lion Square is followed up to a practical issue by making use of the knowledge thus imparted in work connected with the company's business operations and ultimately resulting, in the case of many of the apprentices, in their being taken into the service of the company.

Steerable Balloons.—The centenary of the ascent of the first balloon in England brings news that the second trial of the aëronauts at Meudon has resulted in a failure. The expectations of those who hope to steer balloons must now be turned from France to Russia, where Captain Kosztowitz, the Russian aëronaut, is quite confident that he has solved the problem by a balloon which is at present being constructed at St. Petersburg. It is of the shape of a huge cigar, driven by a screw, but it is also provided with sails. The inventor calculates that his air-ship will be able to make 160 miles an hour with an equipage of 16 men, 10,000 lbs. ballast, and an engine of 50 horse-power. The whole balloon with its appurtenances will be 200 feet long and 80 feet high, and will probably make its first excursion from St. Petersburg at the end of this month. The odds, however, are a thousand to one against Captain Kosztowitz.—*Pall Mall Gazette.*

NOTES.

Electric Lighting.—The *Polyphemus* made a preliminary trial of her electric light machinery at Portsmouth on Wednesday morning last week, and the structural re-adjustments which have been made in her underwater torpedo fittings at the recommendation of a special committee are almost ready for trial. After the testing of the torpedo fittings the official trial will be made of the machinery, which will complete the outfit of the monster. Up to July upwards of £248,475 had been spent upon her, and considerable sums must have been expended upon her since.

On and after Saturday, the 20th of September, the International Health Exhibition will be closed at 10 p.m. on Saturdays. From Monday, the 15th September, the electric light fountain displays will be as follows:—Monday, 8.30; Wednesday, 8.30 and 9.30; Thursday, 8.30; Friday, 8.30; Saturday, 8 and 9 p.m.

Incandescent electric lamps are being used to show how things are getting on in a temperature of 600° Fah., in Messrs. Perkins and Sons' bakers' oven at the Healtheries. The oven door contains a sheet of plate glass, through which the whole of the oven is distinctly visible.

The electric light has been extensively employed at the Russian military manœuvres at Novogeorgievsk, held in honour of the Czar's visit to Poland.

The Jarman Electrical Company, Limited, has just been favoured with the acceptance of its tender by Messrs. Neilson & Co., Hyde Park Locomotive Works, Glasgow, to light part of their extensive works with arc lights. The installation is to be carried out under the superintendence of Mr. Jas. Campbell, the company's manager for Scotland, who has arrangements nearly completed for several very extensive installations.

The managers of the Covent Garden Theatre have again adopted the electric light for this season's promenade concerts. The Maxim-Weston Company has supplied the installation, the work being carried out on its behalf under the superintendence of Mr. Hugh Watt, the managing director of the company. The generating plant is situated on the ground floor just outside the Floral Hall, and comprises three Maxim and three Weston generators. The current from the three Maxims could supply 600 Maxim incandescence lamps, those in use being arranged in the auditorium and over the stage. The Weston machines could supply current to 42 Weston arc lamps; these lamps each give out a light equal to 1,500 candles, autual. The positions of the lamps have been carefully selected, and give a very fine effect, more especially in the auditorium and over the stage, while the Floral Hall is entirely lit by arc lamps. Covent Garden is one of the largest theatres in Europe, and the cables employed in this contract amount to several miles in length. On the occasions of recent visits to the Promenade Concerts we were much impressed by the lighting, which is about the best thing of its kind we have yet witnessed.

Some time back we chronicled the very successful working of an electric light installation at the Wigan Coal and Iron Co.'s works. This installation has given such entire satisfaction, that a further order for the lighting of their large iron works has just been placed in the hands of Mr. F. D'A. Goold, of Manchester.

Mr. Charles Browett, of Westfield, Coventry, having decided to introduce the electric light into his private house, has placed the order for the necessary materials, &c., in the hands of Mr. Goold.

Eddystone Lighthouse, erected by Smeaton and rebuilt by local subscriptions on Plymouth Hoe, will be dedicated as a navigating beacon by the Brethren of Trinity House on the 24th inst., and will probably be electrically lighted.

At a recent meeting of the Committee of the Brighton Town Council which has supervision of the electric lighting arrangements, it was resolved that the surveyor should without delay put up guards to protect the engineers and other workmen at the electric light station from accident when the machinery is in motion, and that the surveyor should report as to the advisability of employing a permanent staff to attend to the electric lighting of the pavilion.

The first application of electricity to the complete lighting of a theatre in Paris has just been completed at the Théâtre de l'Ambigu by the Société l'Eclairage Electrique. The installation comprises 20 Jablochkoff candles and 306 incandescence lamps of 16-C.P. All the lamps are supplied by self-exciting alternating current Gramme machines. There are two type II machines for the incandescence lamps, and two type I machines for the candles. The machines are divided in this way in order to avoid a total extinction in case of accident. The motive power is furnished by two Nayer boilers of 40-H.P. each, and a compound Sulzer engine of 70-H.P., making 80 revolutions per minute.

The Greenock Board of Police has placed the contract for the supply and erection of electric lighting plant with Mr. Edgar Beckingsale, whose tender, which was in competition with those of seven other firms, it was finally decided to accept. The installation will consist of two "Victoria" dynamos of the Anglo-American Brush manufacture, each for 100 incandescent lamps of 20-C.P. The conductors will be lead-cased, of the Kinetic Engineering Company's manufacture, and will be laid underground; the junctures of the branch and main cables will be made in distributing boxes, and smaller wires will be also taken off to the street lamps. The Board is taking advantage of its unrivalled water power, and will utilise it in the production of the current by means of a turbine; it is said that there is an available head of as much as 200 feet of water. We believe that Greenock will be the first town in the kingdom to proceed with its Board of Trade order. Professor Jamieson, Principal of the College of Science and Arts, Glasgow, has been retained as consulting electrician.

The Telephone in Dundee.—Dundee, according to the *Advertiser* of that city, possesses no fewer than 924 exchange wires, over which are transmitted 42,000 messages per week. Considering that the first public telephone wire in Dundee was put up so recently as January, 1880, this development of the use of the instrument has been remarkably rapid. In January, 1880, the Telephone Company, Limited (now known as the United Telephone Company, Limited) came to Dundee and equipped a few wires from an exchange suitated at India Buildings. About the same period the Scottish Telephone Exchange Company also formed an exchange at Albert Square. The *modus operandi* of these two companies was very similar. They erected a few wires gratis, and sought to allure customers at rates of £20 per annum, and £7 10s. per annum. Practically, however, they gained very few. Their wires were not used oftener than 25 times a day, a small service for so high a subscription. Many of the merchants in town saw that, if put to proper account, the telephone might be of great advantage. Consequently a local company—the Dundee and District Telephone Company, Limited—was formed for the purpose of providing the wants of the district in the way of telephonic communication. The arrangement with subscribers was that nothing should be charged until 40 offices had been connected with the exchange. In place of the £20 subscription charged by the outside companies, it was estimated that £10 would be enough. The instruments cost £10 each, which was the bulk of their outlay, so that this rate was apparently ample. The lowering of the subscription at once assured the prosperity of the company. It was formed in July, 1880, and within two months the 40 subscribers necessary to establish it were obtained. By the end of the year upwards of 100 were on the exchange, and vast as that number was then regarded, it has since grown threefold. In 1881 the company had 200 wires in use; in 1882, 270 wires; and in 1883, 320 wires. At the present moment it has 330 wires in connection with the exchange, besides several private wires. This amount of support is due partly to opposition, which has reduced the rate of subscription to £5 10s. For telephonic privileges this is certainly a low charge, and to its cheapness is largely attributable the extensive support given to the telephone in Dundee. This cheapness is entirely owing to the work of the Dundee and District Telephone Company, which has demonstrated that for £5 10s. per annum per subscriber an efficient telephone exchange may be maintained. The 10s. represent the tax levied by the Government, and the remaining £5 is clear revenue available to meet the expenses. The local company has no royalty to meet, and even since its rate was reduced to £5 10s. per annum, it ha been able to pay a dividend of 5 per cent. and put several hundred pounds into the reserve fund.

The National Telephone Company in Dundee.—The list of subscribers to the National Company in Dundee and district has been forwarded to us, and from it there appears to have been a large augmentation during the past six months.

Senegal Cable.—We are informed that the Silvertown Company's ss. *International* arrived at Santa Cruz de Teneriffe on Monday the 15th inst., and that on the following day she landed the Teneriffe shore-end of the Senegal cable in Tejita Bay. This vessel leaves Teneriffe for St. Vincent and St. Iago, Cape de Verde Islands, to survey landing places on these two islands and to sound the route between them. After completing her work between these islands, she will proceed to a point off Dakar, Senegal, from whence she will sound towards Teneriffe. On her arrival there she will meet the ss. *Silvertown* with the deep-sea portion of the Senegal section.

The ss. *Silvertown* arrived at the India Rubber Company's moorings on Tuesday, the 16th inst., and commenced shipping Senegal cable on Thursday, the 18th.

The Mackay-Bennett Cables.—The ss. *Faraday*, carrying the last portion of the second of these cables, left Messrs. Siemens' works, Charlton, on Wednesday, the 17th inst.

Telegraph Wires and Posts in the Country.—Mr. Charles Stevens, of Stevenage, Herts, writes to the *Times*:—"May we ask for your powerful influence to help us in a matter of some importance to country towns and villages. It is naturally expected that the reduction in the price of telegrams from 1s. to 6d. will materially increase the number of messages, and the Post Office are at present engaged in fixing telegraphic posts and wires along the high road to the north of England. These posts are most unsightly objects, and are destroying the pretty primitive character of many of our towns and villages. They are further a source of great annoyance, as the wires are mostly on a level with the bed room floors (not overhead as in London), and in windy weather—as on Saturday and Sunday last—give forth a sad howling noise. Each town through which these wires pass raises its little opposition, and doubtless holds its indignation meeting; but it is an easy matter for a powerful Government department like the Post Office to battle in detail with each village, and to come off the victor. You would, however, render us a great service by urging that these wires, when going through a village or town, be put underground. The extra expense would not be great, the wires themselves would be safer, the beauty of some of our country towns would be preserved, while the irritating howling noise would be entirely prevented."

The Franco-Chinese Difficulty.—A telegraph launch has been fired upon from Kinfai.

The Telegraph Superseded.—The Islands of Reunion and Mauritius are to be connected by the heliograph service, in default of submarine cable connection, which is beyond the resources of local capitalists. Experiments have been made, and the practicability of the system proved, at any rate in the dry season; and as both populations speak French, no diversity of language will arise to prevent the general employment of the heliographic method of communication.

Telegraph Revenue.—The receipts from April 1st to September 13th, 1884, amounted to £835,000, against £830,000 from April 1st to September 15th, 1883.

The Lighthouse Experiments at the South Foreland.—The keen interest taken in these experiments, states the *Dover and County Chronicle* of Saturday last, was heightened by the landing on Monday of a distinguished party in Dover, consisting of the Deputy Master of the Trinity House (Captain Sydney Webb), Captain Weller, Admiral Sir Leopold McLintoch, Captain Nisbet, Mr. J. Inglis, Secretary to the Trinity House, and Mr. A. Owen, from the Trinity Corporation's yacht *Galatea*. This committee has just completed a tour of inspection of the Irish gas lights, and is also engaged in a more direct practical manner in ascertaining the value of the three lights at the above establishment than could be afforded by any photometric measurements, by viewing the lights at sea, during all weathers, and judging for themselves the value of the lights at long and short distances, in fog and in haze. The duration of time originally intended to be given to these experiments has been extended, so that advantage may be taken of the haze and fog that may now be expected. No better proof could be given to the maritime public of the anxiety of the Trinity House to furnish their lighthouses with the best possible light that can be found, than the expenditure of so much time by a committee formed as is the above—the whole of the Elder Brethren being practical seamen—and there is no doubt that the high reputation that this Corporation has held will still be maintained, and that their final report will be without bias, for it must not be forgotten that this is a real contest—although it may seem strange to have a "lighthouse contest"—and will have a direct practical bearing on the cost and efficiency of electricity, gas, and oil paraffin; gas being largely adopted in Ireland, oil—by far the cheapest—by the Trinity House, and electricity where a more powerful light is required. Some very practical results have been obtained, giving the committee a pretty good idea of its ultimate report. In addition to the observations made by the Elder Brethren, lighthouse keepers, lightshipmen, and coastguard, observations are made at sea. Captains of coasting vessels, Orient steamers, and P. and O. steamers are all requested to help, and the lights during this month are on alternate nights exhibited north and south, covering the Goodwin lightship and Ramsgate on the one side, and the Varne lightship and the Coastguard Station at Cornhill on the other, the programme being that they revolve (flash) from 8.45 p.m. to 9.45 p.m.; fixed lights from 9.45 p.m. to 10.45 p.m.; and revolve from 10.45 p.m. to 11.45 p.m.

The Nile Expedition.—A detachment of the Post Office Volunteers which has been selected for service in Egypt, consisting of 12 non-commissioned officers and men, telegraphists, belonging to the 24th Middlesex Corps, have arrived at the camp at Aldershot. This party will be attached to the Royal Engineers at the station until Saturday or Monday, when they will embark for conveyance to Alexandria to join the Royal Engineers' Telegraph Department employed in the Nile Expedition. The telegraph corps, it is stated, will be stationed at Cairo and Assouan, and at relay stations between these places. The twelve trained telegraphists are—five from London, one from the Metropolitan district, two from Manchester, and four from Edinburgh.

The "Phœnix" Dynamo.—Messrs. Paterson and Cooper have constructed two "Phœnix" dynamo machines, which are very substantially built, and are each capable of supplying current for 200 20-C.P. Swan lamps at an E.M.F. of 110 volts. The magnets are of wrought iron, and consist of four bars 5 in. square, two of which run along the top of the machine, and two along the bottom. These bars are supported at each end by strong cast iron cheeks, and secured by wrought iron bolts. In the middle of the top and bottom pairs of bars are fixed the pole-pieces of cast iron, and between these and the cast iron cheeks are the coils, the latter being wound on a dummy, and afterwards slipped in place. The machines are both compound-wound, and are to be coupled together in parallel circuit. The current from the two machines combined is 240 ampères, or sufficient for 400 lights. The compounding is very perfect. The figures below show the excellent behaviour of the machine with different resistances in circuit; the speed being maintained constant at 740 revs. per minute.

Ampères.	E.M.F. at Terminals.
0	110·0
21	112·8
42	112·8
59	112·8
84	112·8
100·4	112·0
104·5	111·2
116·0	110·0
120·0	110·0

Race between two Electric Launches.—A new electric launch, the *Australia*, has just been completed and launched from the wharf of the Electrical Power Storage Company at Millwall. The hull of this launch has been built by Messrs. Forrest and Sons to the order of Messrs. Stephens, Smith & Co., engineers, for an Australian firm. She is of mahogany; length 25 feet, beam 5 feet 7 inches, and she can carry 16 persons comfortably. The motive power consists of a number of E.P.S. accumulators placed as ballast at the bottom of the boat and a Reckenzaun electro-motor driving a two-bladed gun metal screw of 18 inches diameter and 11 inches pitch. The Reckenzaun motor weighs 390 lbs. and is capable of working up to 6 H.P. mechanical, but ordinarily it will be worked at a lower rate—in this boat at the rate of 5 electrical H.P. Weather permitting, a competition trial trip will take place on Saturday (to-day), at 2 o'clock, from Millwall to Charing Cross pier and back to Greenwich, the competing launch being the well-known boat *Electricity*, which caused some sensation when launched in September, 1882. This launch was designed at the time by Mr. A. Reckenzaun for the Storage Company. She is of iron; 25 feet long, and only 5 feet beam. A set of E.P.S. accumulators supply the current to a Siemens D_2 dynamo weighing 658 lbs.; the screw is of steel, made by Messrs. Yarrow & Co., 18 inches diameter and 11 inches pitch. This screw formed a pattern for casting the one in the new launch. It will be arranged that during the trial both machines shall be supplied with the same amount of energy, viz., 3,730 watts, or 5 electrical H.P.

The New Wire Gauge.—A friend writes as follows:—"May I suggest your trying to persuade the 'electrical' public to use the letters 'I.W.G.' (imperial wire gauge), or some other *fixed* letters, to distinguish the new gauge from the old; at present all sorts of initials are being used, such as S.W.G. (standard wire gauge), B.T.W.G. (Board of Trade wire gauge), &c., &c. This is very likely to lead to confusion, and should be nipped in the bud if possible."

Society of Engineers.—A large number of members and associates of the Society of Engineers recently visited the telegraph cable works of Messrs. Siemens Brothers at Charlton, where they had the opportunity of witnessing the various processes connected with the preparation of the materials for and the manufacture of the Bennett-Mackay submarine cables.

An Electric Winch.—The Northern Railway Company of France has adopted an electric winch for its goods depôt at La Chapelle, Paris. It consists of a four-wheeled truck, carrying the lifting apparatus and four small Siemens dynamos, two to act on the winch proper and two to propel the truck, the motion in both cases being transmitted by endless chains. Six men, including the engineer in charge of the dynamos and the fireman, can charge a hundred sacks, weighing together 10 tons, in a space of 48 minutes; and 38 minutes suffice when the winch has not to be displaced.

Electrical Rainbow.—Mr. R. S. Newall, writing to *Nature*, says:—"I was one of a deputation of River Tyne Commissioners who visited the South Foreland to see the experimental lights now on trial there, on Saturday night, August 30th. We were walking across the fields from the lights towards the observing hut No. 2, a distance of about a mile and a half. There was a fog more or less and a shower of rain as we were approaching the hut, and every time the electric light from A tower revolved, a rainbow, very like a faint lunar bow, made its appearance. I could not see any prismatic colour, and the bow was only produced by the large electric light, with carbons of $1\frac{1}{8}$ inch in diameter. There was no bow visible from the old light, which has carbons of about $\frac{3}{8}$ inch square, and none from either the gas or oil lights. I was informed that this was the first time such a phenomenon had been observed."

The Hammond Electric Light and Power Supply Company, Limited.—The *Financial News* of Wednesday last contained the following paragraph: "We understand that the Hammond Electric Light Company has resolved to go into liquidation, and an announcement to this effect is likely to be made during the next few days. As the Hammond owes a large amount of money to the Brush Company, the shareholders in the latter concern are very much interested in this decision, and it might be well for them to take early action looking to their protection. The Brush Company, though it is not by any means in a flourishing condition, can still call up £2 per share on its capital, and may in that way succeed in prolonging its troubled existence. But the Hammond shares, though selling for next to nothing, are fully paid, and there is no hope of relief. If the Brush Company intends to continue its career it should lose no time in closing its affairs with the Hammond, for, with a liquidator once in possession, it would have a very poor show for its money."

This announcement was followed in the next day's issue by the following:—"We are informed that there is no truth whatever in the report that the Hammond Electric Light Company intends to go into liquidation, or that its finances are in such a condition as to give cause for anxiety to its creditors. The statement to the contrary, which appeared in our columns yesterday, was wholly inaccurate, and we are very glad to be able to say so upon the very best authority."

The late M. Jean Baptiste Dumas.—The committee which has been formed for the erection of a statue to the late Jean Baptiste Dumas at his native town, Alais (Gard), is an extensive one. The president is M. Pasteur, and the vice-presidents MM. J. Bertrand, F. de Lesseps, and Cauvet. The members of the committee include all the names of scientific note in France. Among the foreign members are well-known men of all nationalities; the English members being Sir William Thomson, Dr. W. De La Rue, Prof. Williamson, and Dr. Frankland. There is besides a local committee at Alais. With such powerful and wide support the monument is sure to be worthy of Dumas' reputation. Subscriptions should be sent to M. E. Maindrin, Palais de l'Institut de France, Paris.

Death of a Remarkable American.—Rufus Porter, founder of the *Scientific American*, died recently at New Haven, Connecticut, at the ripe old age of 93. The deceased had led a very varied and wandering life, and was very prolific in mechanical invention.

An Electrical Actinometer.—At the last conversazione of the Society of Telegraph Engineers and Electricians, held under the presidency of Prof. W. Grylls Adams, at King's College, one of the novelties was a new actinometer, based on photo-electric action, which was exhibited by its discoverer, Prof. Minchin. The cell sensitive to blue light consisted of a glass test tube filled with alcohol and having a small quantity of nitrate of ammonia at the bottom. Two electrodes or strips of tinfoil, held in position by the cork, were immersed in the alcohol, and when one of these was exposed to a ray from an ignited magnesium wire, a current was set up in the cell sufficient to cause a considerable deflection of the needle of a sensitive reflecting galvanometer in circuit with the two tinfoil strips. In fact, the spot of light went quickly off the scale. That this effect was solely due to the blue or actinic rays of the light was demonstrated by Professor Minchin interposing a plate of orange glass between the cell and the magnesium light. The spot of light was then just seen to move; and if the glass had cut off all the blue rays it is presumed the spot would have been stationary altogether. The strength of current is proportional to the actinic energy of the light. For measuring the effect of sunlight (or another source of illumination) during a fixed time, Prof. Minchin stores the current in a condenser, and measures the discharges at the end of that time. To this end he has devised a clockwork arrangement to close a shutter automatically at the end of the specified time, and thus cut off the light from the cell.

Books Wanted.—A correspondent writes that he is anxious to procure the following books:—"Journal Franklin Institute," cxvi. (60 *et seq*); "Art Notes on the Metallurgy of Nickel in the United States," by Wm. S. Blake, F.G.S.; "Manipulations Hydroplastiques," &c., by Alfred Raselear: Paris, 1880. Also a book (the best of the kind) on the uses of the dynamo machine for electroplating purposes—nickel, silver, and copper.

Taming Wild Animals by Electricity.—It seems impossible to fix any limit to the application of electricity. The most extraordinary use to which it has yet been put is that of subduing ferocious animals. A French wild beast tamer has been experimenting in this way with capital results. Three lions quickly succumbed to the influence of the mysterious force, and showed symptoms of the greatest terror. A tiger was even more readily mastered, but a bear gave a good deal of trouble. Successive shocks were discharged at Bruin without result. He did not like it much, but he did not altogether lose his temper. Still greater power was developed, but his tough hide offered a splendid resistance. By this time he was sufficiently incommoded to become peevish, so he growled a little and showed his teeth. But the operator was too much even for him, and ultimately he also submitted to the inevitable.

An Electric Girl.—The electric girls of Georgia have recently been rivalled in France, for from Paris comes a story, on the authority of M. Arago, Dr. Cholet, and M. Victor Meunier, of a girl named Angelique Cottin, a peasant, 13 years of age, who was working in a factory when a small table near her was violently upset without ostensible cause. Subsequently, in the presence of M. Meunier, she sat on a chair held by several people, when the chair was hurled from their hands. This was tried more than once with like results, the chair being in one case broken when its holders were strong enough not to let it go. When isolation from the ground was produced by glass none of the effects occurred. The only discomfort which the girl ever feels is a pain in the hollow of the elbows. Before a commission of engineers, none of these experiments succeeded; but it is alleged in explanation that the electric properties of her system have, through repeated discharges, lost their force and finally become exhausted.

The World's Telegraphs.—The telegraph appears to have made more progress in the United States than in any other country. The number of American telegraph offices in 1882 was 12,917, and the number of telegrams forwarded during the year was 40,581,177. The number of telegraph offices in Great Britain and Ireland in 1882 was 5,747, the number of telegrams forwarded being 32,965,029. Germany had 10,803 offices, the number of telegrams forwarded being 18,362,173. France had 6,319 offices, the number of telegrams forwarded being 26,260,124. Russia had 2,819 offices, the number of telegrams forwarded being 9,800,201. Belgium had 835 offices, the number of telegrams forwarded being 4,066,843. Spain had 647 offices, the number of telegrams forwarded being 2,830,186. British India had 1,025 offices, the number of telegrams forwarded being 2,032,603. Switzerland had 1,160 offices, Italy 2,590, and Austria 2,696. The number of telegrams forwarded in these three last-mentioned countries was 3,046,182; 7,026,287, and 6,626,203 respectively.

Military Examinations.—A fresh code of regulations in respect to the examinations for admission to the Royal Military College, Sandhurst, was not long since issued, differing materially from those now in force. The new regulations were to come into practice at the beginning of 1885. A new order has, however, recently been promulgated postponing the operations of the new regulations until the summer examination of 1885, at the same time making a number of other alterations in the regulations. In experimental sciences some change has been made. Instead of there being only chemistry, and heat or electricity and magnetism to choose from, there are to be three subjects given—viz. (*a*), the elements of inorganic chemistry; (*b*), elementary mechanics, hydrostatics and pneumatics, electricity and magnetism; (*c*), elementary mechanics, hydrostatics and pneumatics, heat and light. Only one of these three divisions of experimental science can be taken up by candidates, but whichever is taken up there will be, in addition to the ordinary examination, also a practical examination in the subject.

American Telegraphs.—The Bankers and Merchants' Telegraph Company of New York has recently failed to meet its engagements with its servants, some of whom have refused to work any more until the wages due be paid. Some of the operators complain that no wages have been paid them since the 1st of August, except an occasional instalment of five or ten dollars, and some of the linemen actually say that they have got no pay since May. The Bankers and Merchants' Telegraph Company is now pooling with the Baltimore and Ohio Company. The latter organisation recently discharged 300 or 400 men engaged in the work of construction, but it paid all wages due.

Proposed Submarine Cable between Australia and America.—A despatch from Washington to the *Toronto Mail* recently stated that an Australian syndicate proposes to lay a cable from Brisbane, Australia, to San Francisco, and that the Government of the Hawaiian Islands will probably grant a subsidy towards the enterprise.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Signal Company, Limited. — The annual return of this company, made up to the 20th ult., was filed on the 9th inst. The capital of the company is £1,500, in £10 shares. 145 shares have been taken up, and the full amount has been called-up thereon. The calls paid amount to £1,304, and unpaid to £146. Since the registration of the statutory return in November last, 75 shares have been taken, and the paid up capital has increased by £1,104. Registered office, 7, Bridge Avenue, Hammersmith.

At an extraordinary general meeting of the company, held at 62, Hogarth Road, South Kensington, on the 6th ult., a resolution was passed to the effect "That the capital of the company be increased by £1,000." The resolution was confirmed on the 20th ult., and was duly registered on the 5th inst.

River Plate Telephone and Electric Light Company, Limited.—The annual return of this company, made up to the 1st inst., was filed on the 6th inst. The nominal capital is £100,000 in £5 shares; 10,772 have been allotted and the full amount has been called and paid thereon. Since the last return 2,156 shares have been taken up.

Under an agreement of 15th inst. this company will make over 1,910 preferred shares (fully paid) to the Consolidated Telephone Construction Company in full satisfaction of the sum of £7,440 due to the latter company.

Union Electric Light and Power Company, Limited.—At an extraordinary general meeting of this company, held at St. Stephen's Chambers, Telegraph Street, on 22nd ult., it was resolved that the company be reconstructed by the transfer of parts of the assets to a new company to be formed upon terms set forth in a draft agreement made between the liquidators and Mr. T. F. Funnell, as trustee for the company. The resolution was confirmed on the 9th inst., and duly registered on the following day.

Mexican Gas and Electric Light Company, Limited.—The annual return of this company, made up to the 10th inst., was filed on the 16th inst. The nominal capital is £100,000, in 5,000 shares of £20 each. Twenty have been taken up and fully paid, and are held by nine members. Registered office, 15, Bishopsgate Street Within.

Railway and Domestic Electric Lighting Company, Limited.—The registered offices of this company are now situate at 28, York Street, Westminster.

Gülcher Electric Light and Power Company, Limited and Reduced.—An Order of the High Court of Justice, dated 20th ult., and filed on the 8th inst., confirms the special resolution for the reduction of the capital of this company to £150,000 in £5 shares, and authorises the omission of the word "reduced" from the title after the 3rd inst. It is also directed that the registration of this Order be advertised in the *London Gazette*, *Times*, *Daily News* and *Standard* newspapers.

CITY NOTES, REPORTS, MEETINGS, &c.

Pilsen-Joel and General Electric Light Company, Limited.

An adjourned general meeting of this company was held at the offices, St. Stephen's Chambers, Telegraph Street, on Friday, the 12th inst., Sir Rawson W. Rawson, K.C.M.G., C.B., presiding, for the purpose of considering the remuneration to be paid the directors elected on the 28th ult., and to elect auditors.

The Secretary, Mr. E. T. Gregory, having read the minutes of the previous meeting,

The Chairman said: Before proceeding to the immediate purpose of this adjourned meeting, I have to inform you that Mr. Fellows was duly acquainted with the resolution passed at the last meeting, and I had hoped he would have sent me a written answer that I might communicate to the shareholders. He has not done so; but he saw the secretary in the morning and told him that his answer was contained in a note addressed to me on the 27th August, before our last meeting, which he wished to have read to you. It is a very long letter, which was addressed to me with regard to our views respecting our united resignation. It is consequently no answer to the invitation of the shareholders. Therefore Mr. Fellows still holds office under the articles of association, which limits the period of office, according to the letter of the articles, to the year 1886. You will feel, no doubt, gentlemen, with the existing directors, that we are placed in a peculiar position, having been commissioned by the shareholders to carry on the business in the expectation that Mr. Fellows would resign; but Mr. Fellows has not resigned, and therefore it is for you to determine how the business shall be carried on in future.

Mr. H. F. Joel said he was present at the last meeting, and he did not hear that this meeting was to be held at half-past one.

Most unfortunately he had sent out circulars to the shareholders, in which he had stated the time to be two o'clock. The directors had received copies of his circular, and it would only have been right that they should have advised the shareholders that it was an error; but in order to put him wrong they had put the whole of the shareholders wrong too. But for this there would have been a much larger attendance.

The Chairman said, speaking for himself, he could not say that he noticed the point alluded to in Mr. Joel's circular, and as it was in the first notice that the extraordinary meeting would be held at two o'clock, it was distinctly stated that the adjourned meeting would take place half an hour before that for the purpose of completing the business.

Mr. Joel said a number of shareholders would probably arrive at two o'clock, and asked if the meeting might not be postponed until that hour.

The Chairman remarked that nothing could be done with reference to Mr. Joel's circular at two o'clock. The only business which could then be done was to confirm the resolution of the last meeting. It would be contrary to the articles of association.

Mr. Joel said if it was within the province of the directors to bring forward a fourth director, it must be within the province of the shareholders to nominate one.

The Chairman: I think if Mr. Joel had examined the resolutions that were passed at the last meeting with any care he would have seen that it would not be competent for a general meeting to propose a director. Resolutions were passed that three gentlemen should be nominated directors for the ensuing year, and that these three should nominate a fourth, subject to the confirmation of a general meeting of the shareholders. The object of that was not to select any person who had not been under discussion at that meeting; but to conciliate the views of Mr. Ellis, who proposed a gentleman, and Mr. Quilter, who, without naming anybody else, had desired the nomination of somebody else. The sole reason for not nominating another director was that Mr. Quilter and Mr. Ellis might agree together as to the nomination of a fourth director, not that the question should be left to the general meeting, and therefore there is no opening for the consideration of the question which Mr. Joel wishes to bring forward.

Mr. Whatley then moved "that the remuneration of the directors appointed on the 28th August shall be and is hereby fixed at the sum of £100 each for one year."

This having been seconded,

Mr. Joel said he had the proxies of 67 shareholders, representing about 3,000 shares, and he was there to speak for those shareholders as well as himself. Before he could vote for any remuneration he would ask the directors to give some distinct understanding that there would be no further call.

The Chairman said, so far as they could judge, the policy of the directors was in perfect consistency with the wishes and views of the shareholders, and under present circumstances, and any likely to arise within a reasonable period, they did not think it expedient to incur the necessity for raising fresh capital, but they would not bind themselves to any particular mode of carrying out their views.

Mr. Joel said the present board was practically the old one in a new form. It was the old board which incurred the expense, and the late directors, after undertaking to make no calls, first made a call of 10s. and afterwards of 15s. He wished to have it clearly understood what the directors were going to do. It was only fair to the shareholders that they should know what was to be the policy hereafter. Were the directors going to realise the property or going to license out the patents under royalties at once? He had put £2,000 into the company, and he wanted to see if there was some chance of getting it back again.

The Chairman said Mr. Joel's questions were fully answered in the report of the late directors, which was fully adopted by the present board.

Mr. Joel moved as an amendment—"That the question of the remuneration of the directors be not considered until they have clearly stated that no calls will be made, and have also stated how they propose to conduct the business of the company, especially as to the question of royalties."

Mr. J. Ross seconded the amendment, which was put to the meeting amd lost, the original motion being carried by 11 votes to 7.

A poll was demanded by two shareholders, but on its being stated that the chairman could legally direct it to be taken immediately, the demand was withdrawn.

Messrs. Broom, Hays & Akers were appointed auditors, at a remuneration to be fixed by the directors, not to exceed fifty guineas.

An extraordinary general meeting was then held, at which the resolution rescinding the article of association having reference to the directors' remuneration was confirmed.

A vote of thanks to the chairman terminated the proceedings.

Direct Spanish Telegraph Company, Limited.

THE following report of the directors for the half-year ended 30th June is to be presented at the general meeting to be held on Monday, the 29th inst.:—

The annexed accounts for the half-year ended 30th June, 1884, show a balance to the credit of profit and loss of £3,844 5s.

The traffic receipts are £334 18s. 8d. in excess of those for the corresponding half-year of 1883, and show an increase of £243 11s. 5d. over those for last year.

The original Bilbao cable which, as mentioned in the last report, broke down on the 10th of February, was restored on the 9th of April.

The Marseilles-Barcelona cable remained in perfect working order throughout the half-year, and continues so.

The duplicate cable between Bilbao and England was successfully completed on the 12th of May, and was opened to traffic on the 13th of June, since when it has worked perfectly.

The original Bilbao cable broke down again on the 17th of July last, but as the new cable is sufficient for the requirements of the service, the directors do not contemplate restoring the original cable at present.

The cost of the repairs of the original Bilbao cable in April last amounted to £4,292 19s. 10d. Of this amount £3,092 19s. 10d. have been paid out of revenue, and £1,200 have been taken from the reserve fund, which is thereby reduced to £884 1s. 10d.

After providing for the payment of the debenture interest (£590), of the dividend on the preference shares (£3,000), and of £200 towards the reduction of the preliminary expenses account, there will remain a balance of £54 5s., which it is proposed to carry to next account.

The dividend warrants on the preference shares will be issued when the remittances from Spain for the balance of telegraph accounts to 30th June last are received, and these are expected in the course of next month.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotatns, Sept. 18.	Business Done.
		ELECTRIC LIGHT.			
40,000	5	Anglo-American Brush Co.	3	1¼ - 1½	
		Do. Do.	5	2¼ - 2¾	
30,000	5	Australasian E. L., Power & Storage Co.	4	..	
24,900	10	British Insulite Co., Ld., "A" Shares..	6	..	
25,000	5	Gt. Western Electric Light & Power Co.	2½	⅜ - ⅝	
47,233	5	Hammond Elec. Lt. & Power Sply. Co.	5	⅛ - ⅜	5/16
40,000	5	Indian & Ori. Electl. Storage Wks. Co.	2¼	..	
250,000	½	Maxim-Weston Elec. Lt. & Power Co. .	½	⅛ - ¼	
40,000	5	Pilsen-Joel & Gen. Elec. Lt. Co.	3¼	..	
20,000	5	S. African Brush Elec. Lt. & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Ld.....	3	..	
		TELEGRAPHS.			
1,892,480*l*.	Stk.	Anglo-American, Limited	100	30½ - 31½	31¼
2,553,760*l*.	Stk.	Do. Pref. } Def. receiving no div. until	100	54½ - 55½	55½. 6
2,553,760*l*.	Stk.	Do. Def. } 6 p. c. paid to Pref....... .	100	6¾ - 7¼	7
130,000	10	Brazilian Submarine, Limited	10	11⅜ - 11⅝	
16,000	10	Cuba, Limited	10	10¾ - 11¼	
6,000	10	Do. 10 per cent. Preference ..	10	17 - 18	
13,000	10	Direct Spanish, Limited	9	3¾ - 4¼	3¾
6,000	10	Do. 10 per cent. Preference ..	10	14¾ - 15¼	
65,000	20	Direct United States Cable, Ld., 1877 ..	20	10 - 10¼	10 1/16. ⅛. 1/16
100,000*l*.	100	Do. 6 per cent. Deb., repayable 1884	100	98 - 102	
380,000	10	Eastern, Limited	10	11½ - 11¾	
70,000	10	Do. 6 per cent. Preference......	10	13⅜ - 13⅝	13 7/16. ⅝
200,000*l*.	100	Do. 5 do. Debs., repayable Aug. 1887	100	100 - 103	
200,000*l*.	100	Do. 5 do. do. Aug. 1899	100	104 - 107	106
500,000	Stk.	Do. 4 do. Debenture Stock	100	98 - 100	99½. 8⅞. ¾. ⅞
250,000	10	Eastern Exten., Australasia & China, L.	10	11⅞ - 12⅛	12⅛. 12
320,000*l*.	100	Do. 6 p. c. Debs., repayable Feb. 1891	100	109 - 112	
640,000*l*.	100	Do. 5 p. c. (Aus. Gov. Sub.) Deb. 1900	100	103 - 106	104
100,000*l*.	100	Do. 5 per cent. Debenture, 1890	100	102 - 105	
550,000*l*.	100	Eastern & South African, Ld., 5 p. c. Mort. Deb. Rg. redeemable 1 Jan. 1900	100	103 - 105	
22,050	10	German Union Telegraph & Trust, Ld.	10	9¾ - 10¼	
250,000	10	Globe Telegraph & Trust, Ld.	10	6⅞ - 7⅛	7
250,000	10	Do. 6 per cent. Preference	10	12⅝ - 12⅞	
150,000	10	Great Northern	10	13½ - 13¾	13½
100,000*l*.	100	Do. 5 per cent. Debentures ..	100	100 - 103	
300,000*l*.	100	Do. 5 per cent. Debentures ..	100	101 - 104	103. ⅜
81,200	10	India-Rubber, Gutta-Percha, & Tel. Wks.	10	23 - 24	23⅞. ¾
100,000	100	Do. 6 per cent. Debs., 1886	100	102 - 105	
18,000	25	Indo-European, Limited	25	31½ - 32½	
40,000	10	London Platino-Brazilian, Limited	10	4 - 4½	
100,000	100	Do. 6 per cent. Debentures ..	100	101 - 103	
10,000	8	Reuter's, Limited	8	8 - 8½	
338,225*l*.	Stk.	Submarine	100	165 - 175	
75,000	1	Do. Scrip	1	1½ - 1¾	
4,200	Cert.	Submarine Cables Trust	100	100 - 103	
37,350	12	Telegraph Construction and Mainten.	12	32½ - 33½	33¼. ⅛. ¼
150,000	100	Do. 6 per cent. Bonds, 1889 ..	100	106 - 109	
186,750	5	Do. 2nd Bonus Trust Cert. ..	2½	1⅝ - 1⅞	
30,000	10	West Coast of America, Limited	10	5¾ - 6¼	
150,000*l*.	100	Do. 8 per cent. Debs.	100	110 - 113	
45,181	15	Western and Brazilian, Limited	15	7 - 7¼	7⅛
24,729	7½	Do. Preferred	7½	4¾ - 5	
24,729	7½	Do. Deferred..................	7½	2¼ - 2½	
200,000*l*.	100	Do. 6 p. c.. Debs. "A" 1910 ..	100	102 - 104	
250,000*l*.	100	Do. 6 p. c. Mort. Deb. B. '80, red. Feb. 1910	100	96 - 98	
1,500	$1,000	Western Union 7 p. c. 1 Mort. (Bg.) Bds.	$1,000	123 - 125	
1,030,000*l*.	100	Do. 6 per cent. Sterling Bonds	100	100 - 103	
88,321	10	West India and Panama, Limited	10	⅞ - 1⅛	
34,563	10	Do. 6 per cent. 1st Preference	10	7¼ - 7¾	
4,669	10	Do. 6 do. 2nd do. ..	10	4¾ - 5¼	
		TELEPHONES.			
224,850	1	Con. Tele. & Mainten., L., Nos. to 154,165	1	¼ - ⅜	
225,000	1	Oriental Tele. Co., Nos. 80,001 to 300,000	½	⅛ - ⅜	
100,000	5	United Telephone Co.	5	12 - 12½	12 3/16
20,000	5	Do. New, issued at £2 pm.	2	6½ - 7	6⅝

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending September 12th were £2,630, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

The West India and Panama Telegraph Company, Limited. The estimated receipts for the half-month ended the 15th September, are £2,096 as compared with £2,404 in the corresponding period of 1883.

NEW PATENTS—1884.

12300. "Electric locomotive." J. C. MEWBURN. (Communicated by M. Deprez and M. Leblanc.) Dated September 11.

12314. "Means for effecting the breaking, retarding, or stopping the progress of vehicles, and of rotating mechanism by the aid of electricity." A. RECKENZAUN. Dated September 12.

12350. "Secondary batteries or accumulators." D. G. FITZ-GERALD. Dated September 12.

12374. "Electric generator." C. BAUDET. Dated September 13. (*Complete.*)

12430. "Electrical pressure alarm." J. LORRAINE. Dated September 15.

12445. "Effecting communication in telephonic systems." L. J. CROSSLEY, J. F. HARRISON, W. EMMOTT. Dated September 16.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

5917. "Telephonic apparatus." J. D. HUSBANDS. Dated December 29. 4d. The inventor employs a magnet or magnets attached to or in connection with a suitable case, plate, block or other suitable part of sufficiently resonant material. The poles of this magnet are caused to approach and recede from each other by means of a current passing through an electro magnetic coil or coils placed in such a position in relation to the magnet as to give the most effectual molecular disturbance or mechanical movement of the magnet, that is to say, that disturbance which will impart the most intense vibrations from such magnet to the case or other part or parts to which it may be connected to receive or transmit such vibrations in the form of sound waves. (*Provisional only.*)

5924. "Electric arc lights." C. M. SOMBART. (A communication from Buss, Sombart and Company, of Germany.) Dated December 29. 2d. This invention has reference to the construction of electric arc lamps founded on the principle that a straight steel magnet or electro-magnet placed parallel to a conductor, and in which an electric current flows, is urged by the action of the current to assume a position perpendicular to that of the conductor. (*Provisional only.*)

5955. "Manufacture of carbon filaments, &c., for incandescent electric lamps." D. ZANNI and A. SHIPPEY. Dated December 31. 8d. Relates to incandescent electric lamps and comprises improvements in the manufacture of the carbon filaments for such lamps, whereby they are rendered highly efficient for developing the electric light; it also comprises improvements in the manufacture of globes or bulbs for the said lamps as hereinafter set forth. The improvements in the manufacture of the carbon filaments consist chiefly in the treatment as hereinafter described of the strips or pieces of material which are to form the said filaments. The material employed for this purpose may be ordinary moss, straw, cotton, felt, Mexican fibre, rhea, China grass, sea grass, or any other suitable substance. In making the carbon filaments, for either high or low resistance lamps, from ordinary moss, the inventors bring the said moss to the condition of pulp by any suitable means, and add sugar thereto in about the proportion of one part of sugar to three parts of the pulp. When this pulp has attained the requisite consistency it is made into flat sheets, which are cut into strips or pieces of the required size to form the filaments. These strips or pieces, when used for flat filaments, are compressed to a thickness varying according to the candle-power and resistance which it is desired the lamp should have when completed. The strips or pieces thus produced from the moss pulp are then placed, in the ordinary manner, upon a block or piece of plumbago moulded or otherwise made into the shape which will give the filaments the required form, whether horse-shoe, zig-zag, or otherwise. The whole is then put into a crucible and surrounded by powdered plumbago and fullers' earth, a layer of the latter material being placed next to the block, and a layer of the plumbago outside the said fullers' earth. The carbonising is then effected by heating the crucible in a well-known manner to a white heat. The carbon filaments thus produced are withdrawn from the crucible and immediately washed with *aqua regia* (nitro-muriatic acid), and are then subjected to a further carbonisation by placing them in a receptacle containing coal-gas or other suitable gas and connecting them with a source of electricity, such as a dynamo-electric machine or a battery, the circuit being alternately made and broken, so that a coating of carbon will be deposited upon the filaments. The thickness of this coating must be greater or less, according to the desired resistance of the filament. The filaments are then removed from the said receptacle and are dipped in a cold concentrated solution of chloride of zinc or other suitable metallic chloride. After this treatment they are washed first in dilute hydrochloric acid, then in a solution of ammonia and lastly in water, or, with greater advantage, in a solution consisting of gum, sugar and soot, in about equal proportions, mixed with from 60 to 75 per cent. of water. This solution makes the outer surface of the filaments smooth and free from defects, and also makes the said filaments very hard and capable of enduring a more intense current than they otherwise would do. The filaments are then recarbonised in gas, as above described, for a sufficient length of time, according to the resistance and candle-power required When the said filaments are brought into such a condition that they possess the required resistance, the inventors oxidise them by dipping them in a solution of salts of platinum, iridium, palladium, ruthinium, or other suitable metal, or a similar substance. The filaments are then ready to be placed in the globes or bulbs in which they are to be used for electric lighting. All gases and air that may be left in the said globes or bulbs are exhausted by means of a suitable pump so as to produce the required vacuum, and the lamps, when properly exhausted and sealed, are ready for use. For lamps of very high resistance and where long filaments are required for producing great luminosity, the inventors prefer to use compressed felt or goldbeaters' skin; these materials should be soaked in a weak solution of bisulphide of carbon for about 20 minutes, more or less, to remove the grease and fatty matters which they contain, and then washed in water, prior to their carbonisation by the treatment above described.

5986. "Improvements in electro-motors, &c." ELLA HALLER. Dated December 31. 6d. Relates to electro-motors and to magnets of novel construction for use therein and for other purposes. The inventor finds that the power of a magnet depends not upon the mass, but simply the surface and presence of iron, with its high magnetic induction, placed in the closest proximity to the surface of the wires as arranged in the improved magnets, causes the lines of force to alter their shape, and instead of circling around the separate wires, they are distributed on the surface of the iron, concentrating and thereby utilising all the available lines of force at the edges of the rings, segments, or sections of the face of the magnet. In the improved electro-motor, the magnets of the armature and of the field will simultaneously exert a powerful reciprocal action upon each other, and will thus cause a rotary motion of the armature.

1884.

718. "Improvements in voltaic batteries." W. P. THOMPSON. (Communicated from abroad by M. E. E. Senet, of Paris.) Dated January 5. 4d. The battery consists of:—1st. An earthenware or other jar, for containing the water, acidulated in the proportion of $\frac{1}{10}$ by weight. 2nd. A piece of zinc formed into a cylinder placed in the jar just mentioned and immersed in the acidulated water. 3rd. A porous jar placed inside the zinc cylinder or on one side of a piece of zinc of other form, and consequently also immersed in the acidulated water. This jar contains a liquid exciter, which is composed of the following substances, given for a quantity of about one litre:—Saturated solution of sulphate of iron and potash (product known in commerce as "iron alum"), 500 grammes; sulphuric acid, 500 grammes; nitric acid, 40 grammes.

5573. "Improvements in and relating to electrical suspensors or suspensory bandages." C. B. HARNESS. Dated March 27. 6d. The improved suspensor is either made with a series of plates, discs, or pieces of copper and zinc arranged alternately and electrically connected; or it is provided with one or more batteries of any suitable description connected either in parallel or in series. In carrying the invention into practice, according to one method the inventor provides a belt or band of any suitable material, at or near one end of which is the suspensory bag. This bag may be secured to the belt or band by means of buttons or in any other convenient manner, and is provided with straps to pass between the lower limbs of the wearer and be secured by buckles or the like to the said belt or band at the rear or sides of the wearer, in the ordinary manner. To this belt or band are attached a series of plates, discs or pieces of copper and zinc arranged alternately; these plates or discs are usually secured to the band or belt by means of eyelets or rivets. The said plates or discs are electrically connected, by means of gold cord or other suitable conductors, with each other and with a series of plates, discs, or pieces of copper or tin foil, or of copper and zinc arranged alternately, which pieces are attached in any convenient manner to the interior of the suspensory bag, and are included in the electric circuit of the belt or band, and which act as distributors or diffusers of the current, or as current generators when of copper and zinc arranged alternately.

9369. "Improvements in and relating to electric belts or similar appliances, and electrodes or terminals therefor." C. B. HARNESS. Dated June 24. 4d. Relates to electric belts, pads, wristlets, socks, or similar devices for applying electricity to the human body; and to electrodes or terminals to be used in such devices or appliances. The invention mainly consists in making the said devices or appliances, or a part or parts of the same, of woven fabric composed partly of copper or other wire, ribbon or the like, and partly of cotton or other textile material.

10351. "Improvements in apparatus for the production and simultaneous transmission of a series of similar electrical impulses or currents to different termini." G. DOWNING. (Communicated from abroad by W. Fitz-Charles, M. McCarthy of St. Petersburg.) Dated July 19. 6d. Consists of an apparatus for controlling automatically by a single apparatus a number of electric circuits (derived either from a single or from separate sources of current) which are entirely independent of each other, and which have termini locally or geographically apart, in such a manner that given impulses or currents may be simultaneously transmitted or set up in said circuits.

TO CORRESPONDENTS.

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CORRESPONDENCE.

Telephone Wires and Public Highways.

In my communication published in the REVIEW of the 13th inst., I wrote of the decisions of the Courts on this matter.

In the reports of the debates in the House of Commons on 8th July, 1881, the Attorney-General in answer to a question said that "by the Act of 1863, sections 9, 10 and 12, telegraph companies were restrained from placing posts and wires along thoroughfares without the consent of the body having control of such thoroughfares." By the Act of 1868 the Act of 1863 was made to apply to the Postmaster-General. So this Act only restrained telegraph companies and the Postmaster-General; but in relation to other bodies and to private individuals placing posts and wires along public thoroughfares, the responsibility of seeing that they were placed properly and did not cause danger to the public, rested with the body having control of the streets and highways. If any wire were erected to which the local authority took exception on the score of danger to the public, they could restrain the Postmaster-General, companies, or individuals in the matter.

It seems, then, that by the Acts 1863 and 1868 the body having control of a thoroughfare can restrain the Postmaster-General and telegraph companies from placing posts and wires along them; but it seems that other public bodies and private individuals cannot be restrained by the body having control of the thoroughfare unless the posts and wires cause danger to the public.

W. C. B.

September 15*th*, 1884.

Electrical Classes.

With reference to your notice on the "School of Telegraphy and Electrical Engineering," Hanover Square, it would be interesting to learn how many of the 3,000 pupils referred to in your article have obtained appointments in the Submarine Telegraph service through their instrumentality. One of the advantages held out by the late prospectus of the school was the ease with which these could be obtained after the course had been gone through, and it was, no doubt, this which induced many parents (mine amongst the number) to pay the premium and enter their sons for the course. During my experience no one was known to obtain an appointment through their agency, and many were the bitter disappointments. The objects of the school have, however, been lately altered I understand.

W. S.

London, *September* 15*th*.

[The experience of W. S. must, we believe, be exceptional, as the appointments obtained by pupils of the school are by no means so few as would appear from the letter to be the case.—EDS. ELEC. REV.]

The Telephone Companies and the Public.

The telephone companies have for some time been posing before the public as very ill-used bodies. They have complained that the restriction of telephone business in England has been caused solely by the action of the Post Office.

The provincial press to a certain extent has taken up the cry, and pressure both in and out of Parliament has been brought to bear on the Postmaster-General for the purpose of getting certain concessions.

It may not be generally known that one great reason why the use of the telephone is restricted in England is owing to the action of the telephone companies themselves, and especially of the United Telephone Company, which will not itself sell or allow its licencees to sell any instruments, the patent rights of which it holds, and which gives it practically a monopoly of the telephone business in England.

There are hundreds of people throughout the country who would have the telephone, could they purchase the line and instruments right out; and there are hundreds of places where local engineers could get work, where it would not pay the telephone companies to erect and maintain lines.

Now that the companies have gained the concessions they asked for, on the ground of better service for the public, surely they in their turn are bound to do something to extend the use of the telephone.

I maintain this could best be done by selling instruments to responsible persons, and allowing them to fix them, of course keeping a register of the number when sent from the works.

It appears to me that if the companies do not adopt some such plan as this, but still persist in their selfish policy, that the public outside the large towns will not be greatly benefited; and I trust the attention of the Postmaster-General will be drawn to this point before he grants any further demands, otherwise we shall find ourselves groaning under a monopoly which in the near future will be ten times more irksome than that of the gas and water companies.

F. Gervase Olliver.

The "Mechanic Receiver."

By way of reply to the question of "S," and for the information of "W. C. B.," you will perhaps find room for the following:—The "mechanic receiver" is so called because it was described in the *English Mechanic* for August 11, 1876—the first definite intimation in England of the great discovery of Bell. It was thus described:—"Two single-pole electro-magnets, each having a resistance of 10 ohms, were arranged in circuit with a battery of five carbon elements—the total resistance being about 25 ohms. A drumhead of goldbeaters' skin, about 2¾ in. in diameter, was placed in front of each electro-magnet, and a circular piece of clock spring was glued to the middle of the membrane of each drumhead." Then follows a description of the experiments.

S. R.

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